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A
T R E A T I S E
ON THE
S C I E N C E
OF
M U S C U L A R A C T I O N.

BY JOHN PUGH,
A N A T O M I S T.

L O N D O N:
PRINTED FOR C. DILLY.

1794.

Explanation of the Vignette.

ÆSCULAPIUS is represented leaning upon a knotty baton or staff, pointing out the difficulty of the HEALING ART, and our dependence on the Creator. The Serpents entwined around the baton indicate the vigilance which the Art requires, the longevity it brings, and the turns and windings used in employing the means with which man is furnished for his own preservation and relief.

ÆSCULAPIUS holds on the altar the cup and incense by which he sacrifices for the revelation of the Healing Art; on the other side is a representation of the Author, who first discovered, and has fully demonstrated, the great benefit capable of being derived from topical Muscular Action, being peculiarly adapted to the different circumstances of patients morbidly affected.

A
Physiological Theoretic and Practical
TREATISE
On the Utility of the Science of
Muscular Action;



Drawn & Engr'd



by T. Kirk

FOR
Restoring the Power
OF
The Senses

Lost in Laisitude lay all the Man! *POPE.*

By John Pugh
ANATOMIST.

TO

Sir GEORGE BAKER, Bart, M.D.

PHYSICIAN TO HIS MAJESTY,

AND

PRESIDENT OF THE ROYAL COLLEGE OF PHYSICIANS,
LONDON.

S I R,

TO whom could I dedicate a Work like this with more propriety than to one whose literary and medical abilities the world so justly holds in the highest estimation—to one whose character and candour stands so universally con-

B

feffed? 'Tis therefore to you, Sir, I presume to offer these my labours, particularly as they have been sanctioned by your approbation. Gratitude compels me to pay this tribute due to your generosity, happy in the liberality of publicly confessing the obligation, and subscribing myself, with all due deference,

S I R,

Your greatly obliged and

Most obedient Servant,

JOHN PUGH.

Feb. 25, 1794.

*The Author is much obliged to the following eminent Gentlemen
of the Faculty, who have liberally permitted him to publish
their Testimonies in Confirmation of the Importance and real
Efficacy of his System.*

From Sir GEORGE BAKER, Bart.

I AM of opinion that Mr. PUGH's Apparatus, which I
have inspected, is highly beneficial in cases of contracted
muscles.

G. BAKER.

Sackville Street,
January 22, 1793.

*From JOHN HUNTER, Esq.**

S I R,

Leicester Square, March 16, 1792.

I HAVE a good opinion of exercise, as in many cases it may be said to finish where the healing art had done its utmost. I regret very much that your art is not more generally known and practised.

To restore action lost by disease, when the disease has been removed, is the ultimate of our desires ; or to produce relaxation in involuntarily contracting muscles, is much to be wished for, which your mode certainly tends very much to effect.

So far as I have seen, or so far as my judgement goes, I think your Apparatus is well calculated for the above-mentioned purposes ; and it appears that your attention to the human figures has not been wanting ; I wish you success, and whenever opportunity serves, my endeavours shall not be wanting.

Signed JOHN HUNTER.

* The original copy of this letter, under Mr. Hunter's own hand, is in the Author's possession ; and his verbal approbation to Sir George Baker, a living evidence, is a farther proof.

From Doctor LETTSOM.

I HAVE examined Mr. PUGH's System, and the several Machines made use of by him for Muscular Action, in relieving and restoring the strength of the limbs, when weakened by accidents, chronic diseases, and paralytic causes, which I think ingeniously contrived, and of great practical utility to answer these designs, from the benefit derived by Gentlemen of my acquaintance.

JOHN COAKLEY LETTSOM.

Basinghall Street,
London, Jan. 3, 1793.

From J. HEAVISIDE, Esq.

I HAVE examined the principles of Mr. PUGH's Apparatus, and mode of treatment for Contracted Limbs, &c. &c. I think it does him much credit, and is well deserving the attention of the faculty in general.

J. HEAVISIDE.

George Street, Hanover Square,
January 8, 1793.

C



TABLE OF CONTENTS.

<i>Introductory and Explanatory Preface.</i>	-	-	Page: v
INTRODUCTION.--- <i>On the different Effects of Inactivity and Exercise on the human Machine.</i>	-	-	i
C H A P I.			
<i>The Opinions of various Authors on Inactivity and Exercise.</i>			3
C H A P II.			
<i>On the Necessity and Importance of Exercise.</i>	-	-	9
C H A P III			
<i>On the Muscles---how formed.</i>	-	-	28
C H A P IV.			
<i>On muscular Action---from whence the Muscles derive their Power.</i>			34
C H A P. V.			
<i>On the Muscles---with their Uses---and Plates.</i>	-	-	38
C H A P. VI.			
<i>On the other moving Powers of the Machine connected with the Muscles.</i>	-	-	56
<i>Cases.</i>	-	-	76
<i>Conclusion.</i>	-	-	103



INTRODUCTORY AND EXPLANATORY

P R E F A C E.

THE Author of the following work thinks it a duty incumbent upon him to inform his Readers that he dwells solely on the limited subject it treats of, without advancing into the various branches of medical and chirurgical knowledge, any further than appertains to the peculiar treatment of MUSCULAR ACTION, so justly recommended by celebrated medical writers, ancient and modern.

He has given a general concise description of the action, extension, relaxation, use and mechanical operation of the muscles, in a method explanatory of the principles, and demonstrative of the reasonableness of the system laid down for affording relief in the various cases to which it is applicable.

The ease, convenience and good effects which the apparatus will afford to the sedentary, arthritic and paralytic, as well as to children of weak, ricketty and protuberant limbs, will convince every rational and impartial mind of its unequalled utility ; as it promotes, without fatigue, a genial glow and animated circulation ; gives tone to the muscles, easy motions to rigid joints, and healthful action to the fluids—advantages constantly recommended by celebrated writers on the human animal œconomy.

The limbs suffer great debility and contraction from mismanagement at the decline, and after the termination of acute complaints ; and although the disease be removed, the effect most obviously requires a removal also, which the means generally advised could not effect without such topical application ; indeed, the reason which first induced him to undertake and pursue the inquiries which led to the formation of this system, was his too often seeing with regret a number of persons labouring under an incapacity or difficulty of using their limbs.

Upon conversing with several persons of the medical profession respecting the multiplicity of chronic complaints which generally affect the limbs, he found that recreative exercise was by no means adequate to complete a recovery,

because the parts locally affected, thereby, received no benefit—nay, so far from feeling any of the impulsive powers, the limbs were often put into situations rather tending to increase than mitigate the complaints, particularly in the exercise of riding, by the compression of the saddle against the already-contracted muscles.—The same remark applies to a long continued sitting in gouty-wheeling chairs, which may be called a *statue* movement—the using of crutches—wearing of high-heeled shoes—and application of irons—straps—wood, and other injurious strictures—which impede the circulation, and waste and contract the muscles. To obviate the apparent necessity for these instruments of distress, the Author is induced to propose the use of his apparatus, suited to the peculiar case and strength of each patient; and in confirmation of the happy effects proposed to result from the persevering use of the means suggested by him, the reader is referred to the subsequent work, written more with a view to public utility than elegance of style.

Persuaded, from the opinions of the best authors he had read and the lectures he had heard, that strength, vigor and activity were to be given to the muscular system by general exercise, he was also conscious, from repeated experience, that partial exercise would relieve and remove local complaints, and in recent cases of injury or debility,

restore the limbs to the full performance of their proper functions.

The special kind of exercise proper for the different cases that may occur, *when* and *how* to be applied, and in *what degree*, can hardly be the subject of any direction universally applicable; therefore the aid of such an apparatus as is here proposed, with practical instruction for the application, will be found highly useful, if not absolutely necessary.

To this work are added FIFTEEN beautiful figures of the human muscles (drawn from dead and living subjects) as they distinctly and severally appear in different points of view, and engraved in the most masterly manner—demonstrating with precision how capable the several limbs and their respective muscles, joints and ligatures are of being acted upon by proper means, in most cases of debility—contraction—or articular enlargement; and the great probability of muscular action being useful in a variety of cases which have not yet fallen under the author's inspection, but which may be adverted to with success by eminent medical gentlemen, who, being acquainted with the causes of diseases, are proper judges of the appropriate remedies, by investigating their mode of operation under different circumstances. The following elucidation and explanation of the plates may not be unacceptable.

P L A T E I.

Shews some of the muscles of the neck in a state of pain and rigidity; to relieve which, the head should be gently moved in various directions, extending the rigid side of the neck, while the arm of the same side should be stretched downwards, and the painful muscles pressed with care by the soft part of the thumb.

P L A T E II.

Shews the front muscles of the thigh, or the thick part of the shoulder, which, when in pain, the patient should endeavour to throw himself into the position of this figure, placing something soft under the knee.

P L A T E III.

From considering this view of the leg and foot it will appear, that, as in gouty cases, the extension of the feet and instep chiefly suffer, by bending and exercising the toes by means of the apparatus, the suppleness of the ankle may be restored.

P L A T E IV.

From this view it will appear, that the performance of the action represented in PLATE III. will not be adequate to accomplish the desired end, without the additional action of the side muscles of the feet, both internal and external, as well as the back and front muscles of the ankles, which may be readily done, as the ankle in a great degree is capable of the action of the wrist.

P L A T E V.

When the muscles of the lower extremities are weakened, particularly those of the thighs, by rheumatic pains, colds, &c.—an hour's exercise every day, throwing the muscles into the same action as herein represented, will prove essentially beneficial; but in contractions it will prove injurious.

P L A T E VI.

When the tendons of the hams, and the muscles of the back part of the thighs become rigid, this figure points out the mode of giving a full extension to the bellies of those powerful muscles of the lower extremities, from whence in these cases, great utility is derived.

P L A T E VII.

People who lead sedentary lives, and are constantly sitting, are apt to be afflicted with gravelly complaints and costiveness, in some measure, perhaps, owing to the abdominal muscles falling into a state of too great relaxation from that mode of life.—By putting the body in the direction represented by this plate, and ceasing to breathe during micturition, patients have repeatedly found considerable benefit, and been relieved from uneasy symptoms arising from these causes.

P L A T E VIII.

Considerable weakness in the lower extremities, even without contraction of the muscles, often renders them unable to bear the weight of the body, which should not press upon the muscles during the time of giving them action.—The method here represented strengthens the disabled muscles, and throws them into action without fatiguing the patients, and those which have been kept in a state of flexion, or long compressed by sitting in a state of full extension.

P L A T E IX.

As the arms, or other parts of the body, confined for a considerable time in a crooked position, would cause the muscles, even free from any complaint, to contract.—It is an absurd, and even dangerous practice, to have the arms put into slings, except when they are broken, or severely sprained: in order, therefore, to give strength and activity to the muscles, this plate exhibits the mode of accomplishing the purpose, by extending the flexors, or inward muscles of the arm, and thereby throwing the extensors, or outward muscles into action.—But when the arm is contracted and fixed in the state represented by

P L A T E X,

the muscles must not only be put into the actions above specified in PLATE IX. but also have a rotary motion.

P L A T E XI.

This shews the dangerous effects of riding on horseback when the ankles and knees become so contracted that the patient has no power of using them ; for, from this situation, the knees and principal muscles of the thigh are compressed against the saddle, and their action by that means prevented, which impedes too much the circulation of the blood.

P L A T E XII.

It is well known that the action of many muscles, particularly those of the arm, when in a state of torpor, may be lost for want of proper means being used to regain their wonted power. Now if this figure is closely attended to, its position imitated, the difficulties will be conquered, and some causes also of indigestion removed.

P L A T E XIII.

Exhibits to our view the very injurious consequences of wearing high-heeled shoes ; because they contract those parts commonly called hamstrings, shorten the limb, and deprive the muscles from the hip downwards of all their power of action.

P L A T E XIV.

From this we are led to discover the ill effects produced by crutches, which should never be had recourse to, except in cases of fracture of the lower extremities, because the more the body weighs on them, sooner will the thighs and legs lose their power and waste away ; besides, a variety of injuries may occur from the compression of those muscles made manifest by this figure.

P L A T E XV.

From this we are made acquainted with the cartilages or caps of those bones where they form the joints of the knees and ankles, which on dissection have often been found eroded, resembling in appearance the roughness of an old iron hinge. Now this effect frequently arises from want of action sufficient to promote the secretion of a proper proportion of that lubricating fluid called synovia; for it is an allowed axiom, that all glands the more they are agitated, the greater will be the quantity of their peculiar fluid secreted.

Perhaps from the general idea I have given of the modes to be used in restoring the power, strength, and action of the limbs, people totally ignorant of the formation of the human body, with the connections of one part with another, and their dependencies, may be induced to try experiments upon themselves. This would be dangerous—For certainly there is a much greater probability of injury than benefit from such rash attempts.—Much is necessary to be known previous to any application, before success can be expected—Muscular anatomy should be perfectly understood—the nature also of muscular action—and the uses to which particular muscles are appropriated.—Besides, a thorough knowledge is necessary of the means to which, under peculiar circumstances, recourse is to be had—both with respect to the direction of the parts, the duration of the operation—as well as the quickness or slowness of motion to be given, in order to accomplish the desired purposes—

Because, if a person be ignorant of the principles above recited, how can he judge of the proper direction into which the muscles are to be thrown—or the nature of the motion to be given?—And if defective in these points, which form the very basis of practice, he will, nine times out of ten, rather increase than alleviate or cure the complaint he undertakes to subdue.—However, to bring this home to every man's conception, I shall beg leave to state a few Queries—Let the judgement be exercised upon these—the result, I doubt not, will prove the truth of what I have asserted—

QUERY I.

With respect to the following circumstances, under which the constitution is frequently placed, what modes of treatment will be necessary for their alleviation or cure?

A. When the muscles of the neck, termed splenius capitis, splenius coli, mastoideus— (see PLATE I. Fig. 3, 4, 5, 6.) become rigid by gout, rheumatism, colds, cramps, &c.?

B. When the articulation of the shoulder bones and the insertion of the pectoral muscles become contracted, or the deltoid muscle wasted? (See PL. I. Fig. 8. 9. 11. 12.)

C. When the muscles of the extremities are lengthened by paralytic causes, and the part in consequence enfeebled, or when the extremities are shortened?

D. When either or both the lower extremities are relaxed after rheumatic fevers, or when the ankles, knees, elbows, and wrists, are contracted by the gout or any other cause?

E. When the peroneus longus, (see PL. II. Fig. 52.) which arises from the external and superior part of the fibula, or outward bone of the leg, is compressed by irons, straps, &c. or when the limbs are contracted, or shortened by artificial high heels?

F. When the tendo Achillis, by accidents, (see PL. V. Fig. 19.) is too greatly distended, or the flexors of the foot (see PL. VIII. Fig. 11, 13.) become contracted?

QUERY II.

When the inward muscles of the arm, biceps flexor cubiti ulnaris internus, sublimis, palmaris longus— (see PL. IX. Fig. 5, 7, 8, 9.) become contracted, what treatment is requisite to extend the flexors, and throw into action the extensors, and thereby re-establish their flexibility?

QUERY III.

When in a paralytic case, the tibialis anticus, or the most tendinous muscle on the front of the leg turns the foot inward (see PL. V. Fig. 17.) and overpowers the extensor proprius pollicis pedis, and the extensor longus pollicis, (see PL. IV. Fig. 12, 13.) what method must be used to re-extend the tibialis anticus, and throw into action the extensors?

QUERY IV.

When the lower extremities are so much enfeebled, from various chronic complaints, that they cannot bear the weight of the body without assistance, by what means, or by what action can sufficient strength be given to the muscles of the parts affected so as both to enable the patient to bear his weight and to walk?

QUERY V.

When children are weak and ricketty, or have their joints contracted and protuberant, what peculiar treatment is necessary for their relief, in order to avoid the use of irons, straps, high-heeled shoes—which, by the compression they occasion, are in all such cases so highly injurious?

QUERY VI.

Should the ankles be relaxed, or swelled by gout, rheumatism, or any other cause, or should the inward bone called astragalus, (see PL. 15. Fig. 2.) or the external bones become protuberant, what method would be the most proper to be adopted to reduce the swelling, and restore the muscles to their due tension?

To answer these and such like inquiries experimentally has been the object of the author's labors; which he has had the happiness to pursue with no inconsiderable success.

Many other Queries might be started, but these will be sufficient to every candid mind, as they furnish the most irrefragable proofs of the necessity of that knowledge and experience of which we have before spoken ;—

Notwithstanding we consider previous knowledge of some particular points, indisputably essential to a rational and successful practice, without which every attempt is mere quackery—still patients are sometimes so unhappily situated, that they neither can assist themselves, nor be assisted, without the application to some mechanical apparatus ;—which contrivances will, in a very great variety of cases, also contribute to the ease, and expedite the cure of those less disagreeably circumstanced---For instance, when a patient becomes bent almost double, so that he has not power to elevate the superior part of the body from the lumbago, (see PL. XII. Fig. 14.) or sciatica, (see PL. VII. Fig. 19.) how can the parts affected be so alleviated as to assume their healthful action, except by the application of some well-adapted apparatus---The necessity is obvious.—And again, if the flexors or extensors of the fingers become contracted ;—if the circulation of the blood be more languid in one extremity than another, or the limb should be benumbed, some means must be used, by which not only proper motion may be given to the relaxed and inactive part, but also that should be regularly and methodically continued : for random attempts at exertion, by the untaught patients themselves, if continued for the necessary duration, would occasion too great fatigue ; and consequently that motion would be often injurious instead of contributing to relieve, and would tend to aggravate the affections of the parts which are relaxed or inactive, because, though they may receive benefit from exercise in a given degree proportionate to their powers, still should that exercise be carried beyond the due limits, the parts would afterwards fall into a state of greater debility.

Simple as are the plans we have proposed, and salutary in their consequences, we find some experience is requisite in properly conducting them ; without which, the best formed schemes will prove abortive ; but with which, success is attainable even in constitutions the most delicate, and in subjects whilst in their infantile state---For children, as well as adults, in a great number of cases, require various modes of treatment to

relieve them from complaints which too frequently arise from ignorance and inattention.

Nurses will often suffer children, when first they are set upon their feet, to bear *indiscriminately* the whole weight of the body upon the lower extremities, which is apt to occasion protrusions—From want of cleanliness and activity, children too often become rickety—Hence, from these as well as other accidental causes, the joints will become protuberant, the muscles contracted, but more frequently relaxed---To remedy which, it hath been too much the custom to have recourse to contrivances made of iron, wood, and leather, to confine their tender limbs in improper situations, by which the circulation of the fluids is impeded, their activity and remaining powers destroyed, and lameness brought on and even perpetuated.

For children under these circumstances, the author has made it his particular study to invent such modes of treatment as will by degrees assist nature, and thus by gentle means restore strength and vigour to the affected parts---which may be done by properly adapted action alone---In support of which I shall appeal to the experience of many years, and refer my readers to the cases recited in this work, which are ratified by characters of such respectability as will dissipate every doubt and render any further proofs unnecessary.

Before I conclude, I respectfully beg leave to add that I should think myself guilty of the highest ingratitude if I was to omit paying my acknowledgements to a number of my friends for their good wishes during my inquiries, particularly for the unbounded generosity of THOMAS NEWTE, Esq. L. L. D. without whom my labors must still have slept in oblivion ;—therefore, the merit, if any, of this performance, and the utility which may be derived from the perusal of the documents it contains, must in a great measure be attributed to him, who so nobly stepped forward a PATRON to encourage and aid the prosecution of this work, now presented to the public, because it promised to alleviate the miseries of his fellow creatures ; and to whom, I doubt not, many in conjunction with myself will offer the just tribute of a grateful heart.

A N

E S S A Y

ON THE UTILITY AND SALUTARY EFFECTS OF

MUSCULAR ACTION.

I N T R O D U C T I O N.

On the different effects of inactivity and exercise on the human machine.

I N order to preserve or recover health from a state of painful, and too often fatal disease, there have been a variety of plans handed down from HIPPOCRATES, (and even before his time) to the present day, for promoting these purposes. And notwithstanding they have been founded on theories very different from, and often diametrically opposite to each other, still they seem universally to have held one opinion, relative to the great utility of exercise, and the mischief arising from inactivity. And, indeed, in a vast variety (particularly of

chronic maladies) the latter has been allowed, not only to be often the cause, but always the means of aggravating them ; whilst the former has been considered as preventing, always alleviating, and in most cases the principle from whence permanent cures have been obtained — and sometimes so necessary a coadjutor to the powers of medicine, that even the most efficacious have been of no avail without its aid.

It may therefore, perhaps, not be unacceptable to our Readers, before the present subject is entered upon more fully, to be informed of the truth of these assertions, by quotations from various authors eminent in their profession, who have held different theoretic opinions, as well as those who for their guide have depended more upon simple observations.

In order to give a clear and perfect idea of their sentiments, we shall first shew what they have said on INACTIVITY and EXERCISE, with the consequences they have from thence in general deduced ; and this will lead us, with respect to the latter, to some necessary specifications—by which we shall understand, that though exercise may be employed, still it ought to be adapted to the peculiar circumstances of the separate cases requiring its aid:—for by its improper and irregular application it may be useless, nay even dangerous—and that the favourite mode, which is so agreeable, and so universally adopted, RIDING ON HORSEBACK, will, in several cases, be insufficient for answering the desired purposes.— Besides, we shall be supplied with an opportunity of proving that *the air of foreign climates*, which is often advised as a succedaneum for muscular motion, can by no means supply

the defect:—for agitating the machine, and the change of air, though they have, doubtless, many salutary tendencies, still they can never supplant the use of limited muscular action, applied to particular parts;—for there are many local disorders which ask merely for the aid of this topical application, by which their constitutional deficiencies can alone be remedied.

C H A P. I.

WE shall now proceed to point out, by a variety of quotations, the OPINIONS OF AUTHORS ON INACTIVITY AND EXERCISE, with the results from thence accruing.

On INACTIVITY.

“ By being too intent in writing the History of Chronical Diseases, I occasioned the *worst* fit of the gout I ever had, for as often as I went to study, so often the gout returned.”

“ Hard study and too great an application to serious things, greatly dissolve the frame of the spirits, and weaken the instruments of digestion, as melancholy always attends arthritics more than any other, for which reason the gout seizes very few *fools*.”

“ One of our reverend bishops, famous for learning, having studied too hard, and fell at length into a *hypocondriacal* disease, which afflicting him a long time, vitiated all the ferments of the body, and wholly subverted the concoctions.”

“ After repeated attacks of the gout, the limbs without exercise, during the intervals, become contracted and encumbered, so that though a patient may stand and perhaps go a little, yet he creeps along so very lamely and troublesomely, that when he attempts to walk he seems to stand still.”

“ The tendons of the hams and heels are contracted, when by reason of the tormenting pain, the afflicted allow themselves to lie still a long time ; they at length are deprived of the motion of their legs and feet for the remainder of their lives.”

SYDENHAM.

“ Where the assistance of proper exercise has been always wanting, or long discontinued, the due velocity of the circulating blood is diminished, while the muscular and nervous fibres, at first stretched and braced to a fit degree of tension, for want of the labour and activity of the limbs, lose much of their springy force of vibration ; and becoming slack and flaccid, are unable to push on the blood in its canals, which for want of such assistance cannot complete its rounds with a requisite celerity : for this reason the grosser coagulated parts of the blood cannot be exalted and divided minutely enough by striking, beating, and rubbing upon one another with sufficient force ; for as the particles of the blood without mutual attrition and dashing against each other, during the

swift circulation of the mass, cannot receive a proper comminution or subtlety, consequently the just mixture of the whole cannot be well preserved if exercise be wanting. — Hence concretions, tough, and sharp contents continuing coherent and undissolved, fill the glands and nervous fibres with depraved matter that obstructs their passages, and by that means lay the foundation of the gout. The noxious or crude matter that should have been refined by exercise, still remains undigested, stopped, and entangled, and grows up by degrees to ripe chronic distempers. The want of exercise is a *preparatory cause* of the gout, and this is warranted by long experience; for instance, the sedentary lawyer, and the unwearied student, who continually converse with their books, and seldom employ themselves in exercise, thereby often contract the gout. The fauntering, supine, and ositant gentleman, by his birth and great possessions exempt from labour and exercise, therefore is *entitled* to diseases. The cartilages, by long confinement and inactivity, are robbed and deprived of their native oily supplies that used to keep them moist, slippery, and inoffensive to each other, during nature's great expence of her richest treasure." BLACKMORE.

—"Inactive arthritics are afflicted with many other symptoms exclusive of the gout; such as pains of the hemorrhoidal veins, with unfavoury belchings, resembling the taste of the meat last eat, putrefying in the stomach by reason of a scarcity of spirits and want of action; at length the patient languishes, with the whole body, and the gouty one lives only to be wretched and miserable, and not at all to taste of the comforts of life."

—“ The numbness and sleepiness of the limbs after *long sitting* is no other than a temporary palsy ; the pressure upon the branches of the *cauda equina* hinders the circulation of the spirits that way for a while, and the continuance of such a posture would at last dispose to a real palsy.”

—“ Students who write much, should be cautious of their sitting postures, for the famous Dr. COLE, from such a continued posture, got an abscess on the muscles of the belly.”

STROTHER.

—“ An easy, indolent life tends to bring back the bodies of adults to their primitive relaxation.”

—“ Some gouty persons have not been able to sit without a fire the hottest day in summer, and they in general are very sensible of cold, proceeding from a languid circulation, and from the inactivity of the limbs.”

—“ Nothing so certainly lays a foundation for perpetual fits of the gout as exercise discontinued.”

CAVERHILL.

If much study be joined to the want of exercise, it becomes then *doubly* prejudicial, and will, if long pursued, ruin the strongest constitutions.

Hard study never fails to destroy the appetite, and produce all the symptoms already enumerated, with *headachs, vertigoes, costiveness, wind, crudities, apoplexies, palsy.*

I

Diseases produced by sedentary life, must be cured by their contraries, namely, the action of the muscular system.

“ All nervous disorders seem to be but one continued disorder, arising from a relaxation of the solids, in proportion to the resistance of the fluids, in order to carry on the circulation, remove obstruction, carry off the recrements, and make the secretions.”

“ In treating of nervous disorders, the solids are chiefly to be regarded.”

“ The true acquired nervous disorders are produced by intemperance and want of exercise ; the juices thereby have been made fizy or corrosive, and the due tone and elasticity of the nerves and solids relaxed and broken.”

“ If inactivity and want of exercise are joined with luxury, the solids become relaxed and weakened, and the acrimony of the salts and humours gradually increase, then chronical disorders are produced, such as gout, erysipelas, rheumatism, with all the pains, miseries, and torments, arising in this low-sunk state of the constitution.”

CHEYNE.

From what has been delivered, we are enabled to collect, that INACTIVITY renders the humours foul and viscid—causes glandulous and nervous obstructions—*robs the cartilages of their natural oily supplies* ;—is a preparatory cause of the gout—and subjects the studious and indolent to a variety of

chronic diseases.—It destroys the appetite—occasions indigestion—brings on the headach, vertigo, costiveness, wind, crudities, apoplexy, palsy, and other nervous disorders—renders the blood fizy, and the juices acrid—relaxes the solids—and occasions gout, erysipelas, rheumatism, and a variety of other painful disorders.—It brings on the piles—and long-continued sitting in one particular posture creates numbness in the lower extremities, and palsy;—sometimes occasions abscess in the lower belly.—It renders the circulation languid—disposes gouty people to be extremely cold, and lays the foundation for perpetual fits of that malady—It is the means of inducing general debility through the system—melancholy and hypochondriasis—It vitiates the whole juices of the body, *occasions also contractions of the limbs in gouty subjects, and often impedes, through life, the motion of the legs and feet.*—And we may conclude, agreeable with the opinion of Dr. GREGORY, that indolence debilitates the body, renders it irritable, and occasions a languid circulation of the fluids;—diminishes, commonly, all the secretions and excretions, and renders the machine fat and plethoric; and therefore paves the way for most diseases—as hysterics, indigestion, gout, hæmorrhages, apoplexy, palsy, obstructions, and dropies.—In contradistinction to this, let us now see what have been considered to be the effects of exercise.

C H A P. II.

On the necessity and importance of exercise.

“WE must sometimes force the timorous from their beds, and rouse the lazy and sluggish.”

—“Exercise gives strength and firmness to the body, and vigour to the mind.”

HIPPOCRATES.

“If the lower extremities are kept warm by action, it produces a free circulation over the whole body.”

GALEN.

“A certain priest possessed of a rich living, and a martyr to the gout, happened to be taken by the pirates of Barbary, and was detained there a slave for the space of two years, and kept *constantly* at work, which had the following good effect: when he was ransomed from captivity, (having lost all his troublesome and monstrous fatness) he never after had a fit of the gout, though he lived several years after the event.”

VAN SWIETEN.

“The sooner the joints are relieved from contractions by muscular motion, the less danger there is of obstructions fixing in them, but instead of this the general practice is quite the reverse.”

CADOGAN.

“ The increafing of one evacuation is the leffening of another ; and how much exercife increafeth health, is evident from the 7th, 8th and 27th aphorifms of SANCTORIUS compared with the 34th and 35th.”

PITCAIRN.

“ If medicine helps the fluids, exercife helps both fluids and folids, and will diffufe an equal degree of heat all over the body, and, befide, make the acrimonious particles fupply the place of warm internal medicines.”

—“ We muft give an *equal* lift to all the parts of the human œconomy, and not apply to the fluids and *neglect the folids*, (or mufcles) for the ground of all miftakes ought to be imputed to the want of this diftinction.”

“ When I meet with a languid, hyfteric pulfe, I can eafily rife it, and give a full beat to the artery by anti-hyfteric medicines ; but then the nerves are not helped by this, but fometimes impaired : let exercife be ufed, the nerves and the blood partake of the benefit.”

CORNARO.

“ Exercife helps to throw down wind from the bowels, and attenuates the contents of the ftomach.”

“ There is an abfolute neceffity for the fibres and fluids to be counterpoifed by exercife ; the folids during action rebound the fluids, and comprefs them with the fame or equal force ; it is by this mechanifm life is kept on foot ; this is the action

and re-action, so useful in perpetuating the circulation and all its appendages."

"Exercise prepares us for sleep and sends the digested materials into the blood, which fill the vessels, and therefore sleep ensues."

"Exercise is beneficial to hypochondriacs, because the succussions made by it are so many stresses upon the fibrous parts of our bodies, that the watery particles in which they are soaked and relaxed by this mild agitation, exhale, as we see water on the earth does by a gentle heat of the sun."

"Exercise rarefies our juices, re-dissolves coagulations, invigorates our spirits, by which the blood is rendered thin; the spirits are again rightly separated, and all our functions re-commence in an exact manner, and health is thereby recalled, even without the help of medicine."

"Exercise is recommended in nervous rheumatism, and more especially in scorbutic ones; in the scorbutic rheumatism the pains shift from place to place without any swelling, and they are increased by night; but in the nervous, however so wandering the pains, they are accompanied with convulsions in the tendons."

"Exercise opens the pores, softens the fibres and unbends their contractions, and prevents that plenitude or rarefaction, from whence those pains originally sprung."

“ Exercise also serves at once as an evacuant, and a diversion, by which artifices the humours are put into the condition of flying off without the danger of bringing on spasms.”

“ Exercise has a great share in flaving off diseases ; by it our juices are pressed into the minutest canals.”

“ We move by the assistance of our muscles, which change their figures with the blood-vessels stretching themselves along them ; when the muscles are in action, the vessels are squeezed and emptied, and as those sink these fill again ; therefore exercise causes a *systole* and *diastole*, or action and re-action, in the veins, arteries, and lymphatics, and sends the blood forward, and continues a full and regular circulation.”

“ The advantages we reap by exercise are NUMEROUS ; life itself consists in the circular and intestine motions of our fluids, and their uninterrupted passages through canals truly framed.”

STROTHER.

“ Nothing has so salutary an effect on the vessels of the joints as proper exercise, and we have the concurrent testimony of all ages to support this assertion.”

“ By proper action of the knees and ankles, the arthritic promotes the absorption of the fluids, which produce the swellings, and by carrying them off will anticipate the distension of the fibres immersed in them.”

“ When the gout attacks the joints of the feet and knees, the person should be daily attempting to move these parts : a gouty patient will much sooner recover the activity of the limbs by the use of exercise, than by any other means, and prevent the contraction of the muscles, an inconvenience which is apt to remain, when the gout has attacked the knees and ankles.”

“ Let it be supposed, that the first attempts to motion are attended with difficulty, and perhaps some degree of pain ; yet, by gradual and daily repetition, it will become easy, and the muscles more pliable.”

“ If the patient is obliged to interrupt his motion, it should be renewed in a very few hours afterwards, or the following day ; for by persevering in daily exercise to recover the use of the part affected, the resolute patient will certainly at last succeed.”

“ When the gouty symptoms begin in any joint, that joint should be immediately moved, for by this means the fluids are driven back from the separating arteries, which they were urging to destruction, and the tension is taken off the nerves ; the pain therefore soon abates, and the part recovers its usual powers.”

“ When the pain returns upon the discontinuation of exercise, the motion should be renewed and persevered in, and the part at last will be so strengthened, as to be in no danger of a relapse.”

CAVERHILL.

“ Moderate exercise not only corroborates and preserves the muscles, promotes the circulation of the vital juices, enlivens the sensitive spirits, but likewise creates hunger, and assists the concoctive ferments of the stomach, which must be frequently interposed, that the unagitated and lazy mass of blood may not corrupt and putrefy like ponds, and the repositories of the bowels be obstructed, and filled with the aggregated principles of the gout.”

“ In short, the only effectual method to prevent the severity of the gout, is to avoid the causes that produce it, which are enumerated at large, and are offered to the free choice of all, according to the observation in the *CYCLOPEDIA*, “ that the cure of the gout, at least alleviation, lays within every person’s reach.”

“ Exercise preserves the *appetite* and the digestive faculty of the stomach, and wholesome, well-concocted nourishment is conveyed to the veins, and the blood is refined and purified from degenerate humours, that generally protected it from the outrage and cruelty of this formidable disease.”

“ It must, therefore, be of great and general benefit to mankind, and highly becoming the profession of a physician, to suggest any thing of *MOMENT* for the relief and cure of such a malady as the gout.”

“ Exercise, regular and in a moderate degree, such as neither exhausts the spirits, nor gives too great velocity

to the motion of the blood, is very profitable to the patient."

BLACKMORE.

" The operation of digestion, by which chyfication begins, is performed by the *succus gastricus*, which flows continually from the *tunica villosa*, and partly by the action and re-action of the muscular coat of the stomach ; these motions in men are but very weak, and no ways sufficient for digestion without the assistance of the alternate motions of the diaphragm and the muscles of the abdomen."

WINSLOW.

" It is well known, that the stomach is designed and fitted for the digestion of our food, by which it is divided into such small parcels, as will pass through the *lacteals* into the mass of blood for our strength and nourishment."

" The stomach is made of membranous and muscular fibres, filled with arteries, veins, nerves, and glands, by which a viscid matter is separated from the blood, and poured into its cavity for very good ends and purposes."

" The stomach by the help of its muscular fibres, with the diaphragm and muscles of the abdomen, is enabled, with the assistance of exercise, to toss the food about, and if this motion be not the sole, (according to the learned Dr. Pitcairn) it certainly is the principal cause of digestion ; for the force of the muscles by action employed in this business, is almost incredible."

“ Whatever increaseth muscular motion hasteneth digestion.”

“ Exercise mightily promotes digestion by strengthening the fibres, whereby muscular motion is increased, as well as by lessening the quantity of viscid matter separated in the glands of the stomach.”

WAINWRIGHT.

“ As to my own experience, I never saw any thing done to the purpose in nervous cases with success complete, or subsisting, without exercise and diet; therefore it is not my business to collect authorities for a system so UNIVERSALLY acknowledged and so little disputed.”

“ Experience, which extremely confirms the benefit to be derived from exercise, is the only solid foundation to go upon in the cure of *chronical* disorders, and the reason of it is so obvious, that every person must see it.”

“ As diet and proper medicine purify the juices, exercise also strengthens the solids, by *continuing* their actions and motions.”

“ There seems, as it were, new particles to be forced by muscular action into the interstices and ruptures of the solids, to knit and folder, and recover their lost union, cohesion, and spring; so that exercise seems the ONLY, at least the sovereign remedy in relaxed and weakened solids.”

“ Where the perspiration is small, and scarce any at all, especially in chronic and nervous affections, there is an ABSOLUTE NECESSITY of *due* exercise, to supply the want of fun and thin air to remedy these effects.”

“ The neglecting of exercise in our cold climates ought to be reckoned as absurd, as over using it appears fantastical to orientals.”

“ The solids are the great, the proper, and the only instruments of *life* and animation.”

“ For the want of exercise to preserve the tone and elasticity of the solids, laxity and weakness ensue, which produce viscid, sharp, and ill-conditioned juices.”

“ Due exercise will *always* recover a decayed appetite, so long as there is any strength and fund to go upon.”

“ There is not one thing more generally approved of and recommended by all physicians, for the relief of *chronic* complaints, than exercise.”

“ Weak limbs and all the bodily organs may be strengthened and repaired by exercise.”

CHEYNE.

“ I do not know any thing that will so certainly perfect the cure of the bilious colic as exercise, with an *anodyne*, morning and evening.”

“ By a proper kind of exercise the matter causing the disease is brought to the habit of the body, and the blood being broken into small parts by regular motion, adapted to the patient's strength, is separated again, and at length, by daily perseverance, the intestines are much strengthened and refreshed, by this way of stirring up the natural warmth of the blood ; nor am I ashamed to confess, that by exercise I have more than once cured this disease, when I could not cure it by any other way : but exercise is not to be used before the sick is well purged, and then to continue the use of the exercise for many days.”

“ And truly I have known exercise used with *admirable success* in most other *chronical* complaints, if the patient continued it RESOLUTELY, for the organs of secretion are much strengthened thereby from the powerful excitation of the native heat, and restored by exercise.”

“ Without exercise (in conjunction with medicine) the perfect cure of the gout cannot be completed, and all physicians ought to desire this UNION, especially myself, after *thirty-four* years martyrdom ; yet I do well understand the humours of *illiberal* men, that I shall not be much deceived at the unkind reception of my treatise on the gout ; yet I understand and consider it MY DUTY, and therefore shall not be discouraged ; and if the tormenting pains wherewith I have been afflicted can acquire ease for others, I shall receive, now I am passing into another world, some fruit of the misery of this kind I have felt in life.”

“ Though the unfitness for motion may seem to contraindicate exercise, yet it must be undertaken; for no excellent and effectual remedy has been any where experienced, which had not received its chiefest virtues from the aid of muscular action.”

“ The total impotence of the limbs for motion is considerably helped by constant exercise.”

“ The truth of what is said concerning the cause of chronic disorders, will manifest itself by the incredible relief derived from exercise.”

“ For want of exercise the body becomes withered, and the concoctions are no more rightly performed, but on the contrary, the *dregs* of the juices of the body are laid up in the vessels as a stock for the gout, which by exercise in due time may be dispersed and discharged.”

“ Exercise is not to be taken by the bye, but must be constantly and daily used, with the greatest diligence.”

“ Exercise is necessary for those who indulge themselves in luxury, are worn out by sloth, negligence, and hard study.”

“ Whatever assists nature in *daily* performing her offices, by assimilating the chyle brought into the stomach, is properly called digestive, whether it be a rule of diet or exercise; the latter strengthens the blood and renders it brisk, and does

most good in *chronic* cases, such as the gout, which ought to be imputed to the indigestion of the humours.”

“ Our great misery is, that we forsook long ago our ancient and skilful guides, HIPPOCRATES, SANCTORIUS, who so strongly recommend daily exercise for the removal and prevention of *chronic* complaints.”
SYDENHAM.

Indeed, were we to collect whatever had been written on this subject by different authors, it would be merely almost a repetition of what we have already inserted; we shall, therefore, only add, that from the writings of BOERHAAVE, HOFFMAN, and CULLEN, names ever to be remembered whilst medical science exists, it appears that exercise has been one of the principal means by which many of the chronic diseases have been cured; and certainly it appears calculated to be of the utmost utility, for if it is not too violent, it gives strength and vigour to the body, increases the circulation of the blood—assists digestion—thins and divides the fluids—promotes all the secretions and excretions, particularly perspiration—invigorates the spirits, and increases nervous influence in every part of the machine—prevents any sanguinary accumulations—and gives activity and strength to all the muscular fibres—and hence not only prevents but cures a number of diseases;—and we may observe, that those who are accustomed to exercise, are for the most part robust, and seldom subject to complaints, which harass and destroy the indolent and inactive.

But, however, great as are the advantages of suitable exercise, we find that it is not only useless, but dangerous, when

used irregularly or improperly, according to the sentiments of the following authorities :

“ Exercise is not to be taken by the bye, but should be used daily and regularly with the greatest diligence.”

SYDENHAM.

“ If a person takes violent exercise now and then, or only for few days in the course of a month, and imagines by that to counteract all the bad effects of a sedentary life he may have led during the rest of the month, he will be *much mistaken*; for the relaxed state to which his body is reduced by the inactive and studious parts of his life, subjects his arteries to be more easily closed, so that a greater number of them will be rendered impervious by this sudden change of life.”

“ When the causes of relaxation prevail, it demonstrates the absolute necessity of *persevering* in proper exercise, as being the only method of restoring the limbs after an attack of the gout.”

CAVERHILL.

“ Violent exercise, although it often strengthens, and renders the body firm and active, yet it renders it subject to some diseases; partly, perhaps, from the greater density and acrimony of the humors; but more probably from the great power and strength of the solids, and consequently from the great force of the humors; from whence it happens, that some fevers and inflammations are more readily occasioned, and run on to great degrees of violence.—But severe and perpetual labor,

for another reason, exhausts the body, creates debility and dryness, and therefore brings on a premature old age — for that kind of labor, by which great part of mankind support themselves and families, although it may protect them from many diseases, yet hastens decay, and consequently death.— Those who walk in the superior spheres of life, and the rich, though debilitated by luxury and indolence, and often broken down by many diseases, still grow more slowly old, and therefore live longer than the poor artificers and rustics, whom poverty confines to temperance at home and labor.”

GREGORY.

“ As nothing is more conducive to health than moderate exercise, so that which is violent dissipates the spirits, weakens the body, destroys the elasticity of the fibres, and exhausts the fluid parts of the blood—Add to this, that by the violent attrition of the solids and fluids, together with the heat thence arising, all the humors will incline to a greater acrimony, and the salts and oils of the blood will become more acrid and volatile—hence, from severe exercise acute and mortal fevers often arise.”

BOERHAAVE.

Besides, under peculiar circumstances, the exercise ought to be adapted to the nature of the diseases, or their effect, which we wish to prevent, or cure.

“ Those liable to fall into gravelly complaints, or subject to indigestion or visceral obstructions, *riding on horseback* is most beneficial—those subject to the gout, or liable to catch cold, *walking*—to have collection of phlegm upon the lungs,

reading aloud or singing—those who have a strong muscular stamina with a sluggish circulation and coldness, *playing at cricket or tennis*—subject to hysteric diseases, or melancholic affections—where the mind broods too much over imaginary calamities—driving a carriage, shooting, hunting, or some where that reflection may be drawn from unpleasant objects, &c.—and *those exercises which are more or less violent, should be advised according to the ends we wish to promote*;—for the grand end of these are to increase the tone of the solids—make the different glands perform their functions—promote insensible perspiration—and prevent the fluids from becoming detrimental to either, by their thinness, viscosity, or acrimony.”

“ Exercise may be divided into three degrees — the STRONGEST of which are,

FIRST, Playing at tennis, cricket, fencing, running, &c. where great muscular exertion is necessary.

SECOND, Walking, reading aloud, riding on horseback, or in a carriage.

LAST, Sailing, chamber horse, dumb bells, and frictions,—which last are appropriated to old age, where muscular force begins to grow effete, and are necessary for the preservation of health, by promoting the circulation of the blood, and motion of the fluids, through the minute vessels. WALLIS.

If we reflect on what has here been advanced, we shall be clearly convinced, how insufficient the change of climate

will be to promote the purposes of muscular motion.—
For,

“ The joint power of warm air and light food cannot supply the place of exercise in keeping the joints pliable and moveable, and preserving them from growing rusty and stiff: light food may in some measure prevent the thickening of the fluids, but cannot do it sufficiently without the aid of exercise, nor can it at all keep the fibres in due tension, for to that purpose exercise is absolutely necessary.”

“ Exercise is not only necessary in the colder climates, and where the food is gross, but even in the warmest climates; for though the warmth of the air may keep the perspiration free and open, yet at the same time, and by consequence, it will thicken the fluids and relax the fibres, therefore, in order to prevent both, exercise is absolutely necessary.”

CHEYNE.

Nor shall we be less at a loss to discover how inadequate will riding on horseback be, in many particular cases, to answer the desired intent, where the joints, ligaments, and muscles of the lower extremities, are in a debilitated or contracted state.—For,

“ The feet and knees of disabled arthritics have nearly as little exercise on horseback, as when the body is in perfect rest; they have only a kind of tremulous motion, which is so very inconsiderable, when compared with the great action of progression, that it does not merit the smallest attention.”

“ The feet and the lower limbs will even be found to be *injured* by riding on horseback ; for the weight of the blood between the feet and the heart is continually pressing upon the cohesion in the feet, as it always does when the body is carried perpendicularly.”

“ Riding strengthens only one half of the body ; the *lower limbs* thereby are much *injured*, and many fatal consequences may follow, in arthritic cases, from inattention to this inequality of resistance.”

CAVERHILL.

“ Some men are so overween in favor of riding on horseback, that we hear all its encomiums ; it is set in so advantageous a light, that they have not neglected to mention the least benefit received by it, and they seem to attribute more than its *single* share, and aim at a panegyrick.”

“ Exercise, of whatever kind it be, should be properly suited according to the case.”

STROTHER.

Riding on horseback, with other common exertions, are well adapted for the healthy and active, who have the free use of their limbs, to recreate themselves according as their fancy leads them ; but very inefficacious for arthritics and invalids, who are deprived of the power of using their limbs.

To point out the inutility of riding for the relief of cases where the joints are become contracted, and the circulation languid, require but a slight investigation ; for instance, those in perfect health, who are long on horseback,

lose a portion of the vigour of the *lower extremities*, by the muscles being compressed, and the full crural arteries somewhat impeded, and the circulation of the fluids rendered more languid.

Riding is only *one* exercise, and that of a jolting motion to the weak and almost useless joints, though continued for half a day; the knees, ankles, and feet, which chiefly require action, hang motionless throughout this *philosophical* journey.

One and the *same* exercise for various local complaints, can no more be effectual than one medicine in various acute complaints.

Surely, four hundred and seventy-four muscles, and two hundred and forty-seven bones, which the human body consists of, require both partial and universal action, nor is it to be supposed that such a group of muscles and number of joints can remain in right order without being duly regulated.

Exercise which is to be procured by riding, or from walking, has no tendency to correct either stiffness of the joints, the effects of sprains of long standing, or to reduce callous and inelastic swellings round the knees and ankles, or to restore the muscles, when contracted, to their proper tone and flexibility.—It is clear that muscular action should be appropriated to the parts affected, which, in a variety of cases, cannot be acquired by any plan of general exercise, hitherto discovered.—For we shall see by all the quotations we have already given, as well as the succeeding, that

muscular action has been recommended, and in some cases, that also local—still to the proper modes, the whole have appeared strangers—After, therefore, supplying two or three quotations, we shall give our ideas of muscular action, and shew the necessity of the distinction at which we now only hint; reserving the further discussion for the conclusion of this work, which is intended to convince our readers, on the principles of reason, that however useful the exercise hitherto practised may be in general to the human machine, particular muscular action cannot always be dispensed with.

“ A perpetual afflux of blood is plainly necessary, in order to keep the tendons flexible, which muscular action is capable of performing by promoting a regular circulation, and further its designs.”

STENO.

“ The loss of sense and motion generally attends the relaxed palsy, from the thickening of the juices, as appears from the languid circulation; and in both the contracted and relaxed palsies it is evident, that muscular action will be of additional service after *batning*, as observed by WYNTER.”

“ Every point and particle of the solids are elastic, and act for the relief of the whole.”

CHEYNE.

“ Neither waters, medicine, nor regimen, will restore a gouty patient in half the time, as they will do when joined to exercise: a little attention to the theory of animal secretion will shew the insufficiency of purges unassisted by exercise; how is a medicine, which is calculated to scour and cleanse the first passages, to renew muscular strength?” WARNER.

C H A P. III.

HAVING shewn, from a variety of authorities, what good effects arise in some cases from exercise in general, and also that in others, exercise appropriated to particular parts is equally necessary, where the machine, or parts of the machine, are in so debilitated, or otherwise diseased a state, that patients are incapable of applying such sort as is best calculated to alleviate or cure the distress—We shall now go more fully into the nature of muscular action; and in order to give a clear idea of what we propose for the benefit of mankind, who labour under these infirmities, we shall first point out *of what a muscle is formed—its properties from whence arising, and explain the nature of those powers by which it is actuated*—and afterwards give an account of various muscles, with their uses—such as will readily meet the eye of any common observer—and be made manifest by a number of plates, with proper references, explaining the different states in which they are placed, whether in ACTION, EXTENSION, OR RELAXATION.

Amongst the various parts which form the human machine, the nature of our present work confines us only to a few, and those chiefly which are appropriated to motion, and parts most intimately connected with them for this purpose—These are bones,—cartilages,—ligaments,—and muscles, with their tendons—which we shall proceed to describe, giving only of

them a concise view, sufficient to make us understand the nature of muscular action.

FIRST. “ The bones are the hardest and most solid parts of the human machine, calculated to support those which are soft and firm in all their motions and pressures; they are covered with a membrane, or thin bladdery substance, called *periosteum*, on account of its covering the bone, which is exquisitely sensible, being plentifully supplied with nerves and blood vessels. The outsides of bones are commonly more compact than the inner parts; and are formed of plates, joined together by transverse fibres; their insides are spongy and cellular, in which is contained marrow, within membranous bags, filling up the cells; this marrow, being more or less distributed all over the bones, and transfusing through their plates and fibres, makes them tougher and less brittle; the bones are supplied, both within and without, with blood vessels and nerves.

SECOND. “ Cartilages, or gristles, are solid, smooth, white, elastic substances, between the hardness of a bone and that of a ligament, covered with a membrane called *perichondrium*, because it covers a cartilage, which is akin to the *periosteum* of the bones; they serve to make the bones, whose extremities or ends they cover, move freely in the joints: they limit the growth of bones, as to their length, by hindering the bony fibres from sprouting out; and, therefore, when the cartilages in the joints are eroded, an immobility is there formed, called *anchylosis*, or stiff joint, by the elongation and coalition of the fibres of the bones that are

articulated together; sometimes they serve as ligaments to join the bones together, and sometimes they do the office of bones to greater advantage than these would do; as the cartilages of the ribs, which, by their elasticity, chiefly contribute towards expiration; the cartilages that make out brims of cavities, &c.

THIRD. “ Ligaments are made of white, tough, fibrous layers or strata without cavity, the largest and strongest of which run lengthwise; stretched with difficulty, and of little elasticity, (excepting the ligaments surrounding the wrists and insteps, which are thin, flexible, and capable of expansion and extension) thicker and firmer than membranes, and not so hard or solid as cartilages; they serve to connect and keep together, in a proper situation, the parts to which they are fixed to, as appears remarkably in the articulations.

FOURTH. “ Muscle, of which in the human machine, there are three different sorts;—the LONG MUSCLES of the trunk of the body and limbs, which not only are put into action by the power of the will, but remain a long time in a contracted state; although, if left to themselves, may soon be relaxed;—the HOLLOW MUSCLES, that is, muscular fibres which surround some of the hollow organs of the body, and cannot of themselves shew any relaxing power, as in the heart, arteries, intestines, and bladder—although the functions of these parts being well understood, prove that relaxation succeeds their contractions;—and lastly, the SPHINCTERS, or those muscles which close the mouths of tubes or cavities before which they are placed, and never in a man in perfect health appear to be relaxed.—Now all these muscles, according to

the opinion of most anatomists and physiologists, particularly the illustrious HALLER, are made up of small bundles of red thread-like appearances, by which all perceptible motion is performed—when more fibres, and these more evidently red, are united together, then is the collection called a MUSCLE.

In every muscle, long, slender, soft fibres are found possessed of some elasticity, running universally parallel with each other, which, surrounded with a plentiful portion of cellular membrane, are collected into what are called LACERTULI, that is, in shape like the arm from the elbow to the wrist—these bound together with a looser, and for the most part fatty membrane, run into larger bundles, which are always divided by cellular stripes or partitions, then called LACERTI, which also running either parallel or inclined, surrounded with a thin cellular membrane continuous with the partitions, and separated by a thicker cellular texture from the neighbouring fleshy parts, are considered as one muscle.—In every perceptible fibre there appears a series of filaments, which being mixed and united with one another by oblique terminations, are joined in a larger fibre; so that we find one perfect muscle consists of a number of bundles, and these of a number of simple fibres.

In a great number of muscles, particularly those which are inserted into the bones, and are pressed by other strong fleshy parts lying above them, there are different kinds of fibres—for the fleshy fibres collected in the middle of the muscle create a degree of thickness there, which is named the BELLY, and these in their progress to each termination of

the muscle grow gradually smaller and more firm, having lost their redness assume a shining, silvery appearance, and approaching nearer to each other, collected in a thin cellular membrane, and shorter, are spread over with fewer vessels, are more inactive, and not readily irritable—these then receive the name of *TENDONS*, if they are united into a smaller round bundle; but if they are spread out into a broad smooth surface, *APONEUROSIS*—The cellular coat which surrounds the whole of the tendon, like the common tunic of a muscle, is called *VAGINA*.

That the tendons are formed from the fleshy fibres, we shall be convinced by comparing the foetus, which has very few tendons, with the grown boy, which has many more, and which in the adult and aged are greatly increased, particularly the latter. Muscles having no insertions into the bones, most commonly have not any tendons, as the heart, the sphincters, the tongue, the muscular membranes of the vessels and viscera.—But where they surround the joints and heads of the bones, called epiphyses, the tendons there are very long, and in those extremities which require more motion.—In the foetus it is manifest, that the muscles are inserted only into the membranous covering of the bone, called *periosteum*—but in adults, where the periosteum is intimately united with the bone, the muscular fibres confused with that covering penetrate into the foveoli of the bone itself.

In the cellular tunic surrounding the fibres, arteries, and veins, are divided, and form net-work at right angles, accompanying for the most part, and running contiguous with

each other; whence a vapor is poured out into the thin, and fat into the thicker cellular membrane, from whence they are both again reformed. The lymphatic vessels, which run betwixt the muscles of the tongue, neck, face, are with difficulty demonstrated—But the nerves are distributed with the vessels through the cellular membrane of the muscles, more copiously than to any other parts of the body, except the eye—though having lost their firmer involucrum, or covering, become softer, and disappear before they can be traced to their ultimate termination—They enter the same muscle at many places, but have not any peculiar for their entrance.—In the tendons they cannot be demonstrated—neither are there any nervous fibres which surround and bind the lacerti, or larger bundles of muscular ones—those who have described them, having discovered nothing except cellular membranes.

Such, then, the particular structure of the muscles, we must now see from whence they derive their power.

C H A P. IV.

MUSCLES manifestly possess, like other solid parts of the human machine, a great degree of ELASTICITY, that is, the power of re-assuming their own form, when stretched beyond their natural limits by any distending force, on the cessation of the action of that force, which power continues even after death—whatever other motion it has more, that depends upon LIFE and the *connexion which is formed betwixt them and the brain and nerves.*

Besides this they have also a tonic power, that is, strength and activity united—which extension keeps ready for action, and this acts as a stimulus, to which every muscle is subservient—for almost all the muscles of the living machine are extended, more or less, beyond their natural state, that is, such a state as, if unconnected, they would spontaneously possess—This extension is occasioned particularly by the bones themselves increasing with which they are connected, as well also as by the action of the opposite muscles, and the weight of some parts which the muscles are destined to support; and finally, by the fullness of the organic cavities or viscera, which they surround, or with which they are by some means or another connected.

Now, the greater the extension the more is the tone and the vigor of the action of a muscle increased—the less, the

weaker will be its powers—this is proved by the circulation of the blood being quickened and augmented by the fullness of the vessels—which effects are taken off in many diseases by bleeding, than which we have not a more certain and immediate auxiliary in mitigating the impetus of the blood. But this tonic power, as far as it depends upon extension, is confined within certain limits ; for, so far is a great and continued extension of muscular fibres from rendering their contraction easier and stronger, that often it weakens and destroys it—and thus muscles commonly lose their power and are rendered incapable of either suddenly or with facility recovering their former strength.

Moreover, a muscle, not in a state of extension beyond its proper limits, contracts itself by the application of any stimulus. To this power physicians have given the name *instita*, inherent—Again, should no stimulus be applied to the muscle, but to the nerve which it receives, the same motions will be excited—or if the brain itself should be irritated, a great number or all the muscles will be convulsed—this state or condition of the muscles is termed the *vis nervosa*, or nervous influence, and is said only to differ in situation from the *inherent power*.—And lastly, should there be no irritating cause applied to the muscles, brain, or nerves, by the will alone we can throw many muscles into action ; and this is properly called *animal*, as it belongs alone to the animal creation, and considered as *voluntary* motion.—Yet still all muscles are not subject to the will ; for a great number, and those of the utmost consequence in the animal œconomy, are performed where the mind is unconscious of such motion,

may act against the will, even when it contends to prevent such effects; these are termed *involuntary*.

The *voluntary motion*, or those under the command of the will, are those of the muscles of the head, face, eyes, trunk of the body, limbs, in an healthful man; although sometimes without any disease, those muscles may be put into action, the mind unconscious of, or contending against such motion.

The *involuntary* are those of the heart, arteries, secretory organs, of the whole intestines from the pharynx to the extremity of the lowest intestine, the pupil of the eye, and other sphincters; though indeed over many of these the will bears some degree of power, particularly of the urinary passages, bladder, uterus, and bronchia of the lungs.

The muscles of respiration hold a middle place amongst these, viz. the diaphragm, the muscles of the abdomen, or belly, and those which are situated between the ribs, and as many as are so united with them, that their contraction can either fix, elevate, or depress the ribs.

Thus much have we thought necessary to say with respect to the formation of muscles, and the powers by which they are actuated, either adventitious or inherent in themselves, agreeable to the opinions of the best authorities—that our readers may be prepared to receive information by what means the exercise, we intend hereafter to propose, produces its salutary effects, and enabled to judge of the rational prin-

ciples upon which it is founded—This part of the subject we shall therefore close with observing,

That muscles of voluntary motion, by strong and proper exercise, admit it is not too violent, renders them firmer, more active, and stronger, and makes them more fleshy or brawny—hence, from the appearance of the form itself, are we apt to judge of a man's strength. This matter is perfectly understood by sculptors, who know how to vary their manner, as far as respects the muscles, when they would produce the figure of an HERCULES, an APOLLO, or a VENUS.

Strength and mobility of every muscle are increased by use; and also, the conjunction of many muscles, which contributes to perform the same motion, often repeated, becomes by custom more easy, quicker, and more accurate.

C H A P. V.

HAVING spoken of the muscles with regard to the nature of their formation, and the powers by which they are actuated—in order to give our readers a perfect idea of these instruments of motion, we shall now exhibit a table of the whole external muscles, with the appropriate uses, and then present them with different views in their states of CONTRACTION, EXTENSION, and RELAXATION—by which they may clearly understand the situation of them in different actions, and better conceive by what means the morbid causes are likely to be removed.

THE GENERAL USES OF THE MUSCLES,

SPECIFIED IN THE FOLLOWING PLATES;

*To which references may be occasionally made.**Muscles of the NECK.*

PTERYGOIDEUS EXTERNUS	Pulls the lower jaw forwards, and the opposite side, and also the ligament from the joint, that it may not be pinched during these motions.
STERNO THYROIDEUS	Draws the larynx downwards.
— CLEIDO MASTOIDEUS	Turns the head to one side, and bends it forwards.
SPLENIUS CAPITIS	Brings the head and upper vertebræ of the neck backwards laterally.
— COLLI	Pulls the head directly backwards, when acting conjointly with the splenius capitis.
TRACHELO MASTOIDEUS	Assists the complexus, and pulls the head sideways.

Muscles of the TRUNK.

INFRA SPINATUS	Rolls the humerus outwards, and assists in raising and supporting it when raised, and pulls the ligaments from between the bones.
INTERCOSTALES	Raises the ribs equally upwards during respiration.
LATISSIMUS DORSI	Pulls the arm backwards and downwards, and rolls the os humeri.
LONGISSIMUS DORSI	Extends the vertebræ, and raises and keeps up the trunk of the body erect.
OBLIQUUS ABDOMINIS EX- TERNUS	} Assists the inferior part of the rectus abdominis.
————— INTERNUS	
PLATYSMA MYOIDES	Assists in drawing the skin of the cheek downwards.
PECTORALIS MAJOR	Moves the arm forwards and obliquely upwards towards the sternum.
————— MINOR	Brings the scapula forwards and downwards, and raises the ribs upwards.
PYRAMIDALIS	Assists the inferior part of the rectus abdominis.
QUADRATUS LUMBORUM	Moves the loins to one side, and pulls down the last rib, and when both act, it bends the loins forwards.
RECTUS ABDOMINIS	Compresses the fore and lower part of the belly, bends the trunk forwards, and raises the pelvis.
SERRATUS MAGNUS	Moves the scapula forwards, and, when the scapula is raised, draws upwards the ribs.
————— SUPERIOR	Elevates the ribs, and dilates the thorax.
————— INFERIOR	Depresses the ribs into which it is inserted.
TRAPAZEUS	Moves the scapula in three different directions.
TRANSVERSALIS	Supports and compresses the bowels, it being their chief constrictor.

————— of the ARMS and HAND.

ABDUCTOR POLLICIS MANUS	Draws the thumb from the fingers.
ADDUCTOR	Pulls the thumb towards the fingers.
ABDUCTOR INDICIS MANUS	Brings the fore-finger towards the thumb.
————— MINIMI DIGITI MANUS	} Draws the little finger from the rest.
ANCONÆUS	
BICEPS FLEXOR CUBITI	Assists in extending the fore-arm.
	Turns the hand supine and bends the fore-arm.

BRACHIALIS EXTERNUS	Extends the fore-arm.
———— INTERNUS	Bends the fore-arm, and prevents the capsular ligament of the joint from being pinched.
CORACO BRACHIALIS	Raises the arm upwards and forwards.
DELTOIDES	Pulls the arm directly upwards and outwards, and a little forwards and backwards.
EXTENSOR DIGITORUM COMMUNIS	} Extends all the joints of the fingers.
———— PRIMI INTERNODII	
INDICATOR	Extends the first bone of the thumb obliquely upwards.
INTEROSSEUS AURICULARIS	Extends the fore-finger.
PALMARIS BREVIS	Pulls the little finger to the rest.
———— LONGUS	Assists in contracting the palm of the hand.
	Bends the hand, and stretches the membrane that is expanded on the hand.
PRONATOR RADII TERES	Rolls the radius together with the hand inwards.
PRIOR MEDII	Extends, and draws the middle finger inwards.
———— INDICIS	Extends the fore finger.
———— ANNULARIS	Extends the ring finger.
RADIALIS EXTERNUS	Extends, and brings the hand backwards.
———— INTERNUS	Bends the hand, and assists in its pronation.
SUBLIMIS	Bends the second joint, or phalanx of the fingers.
SUPINATOR RADII LONGUS	Rolls the radius outwards, and the palm of the hand upwards.
TERES MAJOR	Rolls the humerus inwards, and draws it backwards and downwards.
———— MINOR	Rolls the humerus outwards, draws it backwards, and prevents the ligament from being pinched between the bones.
ULNARIS INTERNUS	Assists the radialis internus in bending the hand.
———— EXTERNUS	Assists in extending the hand.

Muscles of the THIGHS.

ADDUCTOR TRICEPS FEMORIS	} Brings the thigh inwards and upwards, according to the different directions of its fibres, and rolls the thigh inwards.
GRACILIS	
GLUTEUS MAXIMUS	Assists the sartorius in bending the leg obliquely.
	Extends the thigh by pulling it directly backwards and a little outwards.
———— MEDIUS	Draws the thigh bone outwards, a little backwards, and rolls it outwards.
———— MINIMUS	Assists the gluteus medius in pulling the thigh outwards and backwards.

CRURALIS	Assists in the extension of the leg.
ILIACUS INTERNUS	Assists the psoas in bending the thigh and in bringing it directly forwards, and also to raise the pelvis.
PECTINALIS	Brings the thigh upwards and inwards, and gives it a degree of rotation outwards.
Psoas PARVUS	Assists the psoas magnus; also to raise the pelvis.
———— MAGNUS	Bends the thigh forwards, and assists in bending the body.
POPLITEUS	Assists in bending the leg, and prevents the capsular ligament from being pinched, and when the leg is bent it rolls it inwards.
RECTUS FEMORIS	Extends the leg in a powerful manner by the intervention of the patella, like a pulley.
SARTORIUS	Bends the leg obliquely inwards, and brings one leg across the other.
SEMITENDINOSUS	Bends the leg backwards and a little inwards.
SEMIMEMBRANOSUS	Bends the leg and brings it directly backwards.
VASTUS EXTERNUS	} Extends the leg.
———— INTERNUS	

Muscles of the LEGS and FEET.

ABDUCTOR INDICIS PEDIS	Pulls the great toe inwards to the small toes.
———— POLLICIS PEDIS	Pulls the great toe from the rest.
———— MINIMI DIGITI PEDIS	} Draws the little toe outward from the rest.
ADDUCTOR POLLICIS PEDIS	
EXTENSOR LONGUS DIGI- TORUM PEDIS	} Extends all the joints of the four small toes.
———— PROPRIUS POL- LICIS PEDIS	
GASTROCNEMIUS	Extends the foot by bringing it backwards and downwards.
PERONEUS LONGUS	Moves the foot outwards.
———— BREVIS	Assists in pulling and extending the foot outwards.
PLANTARIS	Assists the soleus to pull the capsular ligament of the knee from between the bones.
SOLEUS	Assists the gastrocnemius in extending the foot.
TIBIALIS ANTICUS	Bends the foot by drawing it upwards, and at the same time turns the toes inwards.
———— POSTICUS	Extends the foot, and turns the toes inwards.
TENDO ACHILLIS	Assists the soleus.

P L A T E I.

*Front View of the Muscles of the NECK,
In the different States of Action, Extension, and Relaxation,*

Specified in the margin by the Letters A. E. R.

1. Sterno thyroideus,	-	-	A.
2. Pterygoideus,	-	-	—
3. Sterno cleido mastoideus,	-	-	—
4. Trachelo mastoideus,	-	-	—
5. Splenius capitis,	-	-	R.
6. ——— colli,	-	-	—
7. Trapezeus,	-	-	E.
8. Pectoralis major,	-	-	R.
9. ——— minor,	-	-	—
10. Platysma myoides,	-	-	E.
11. Coraco brachialis,	-	-	R.
12. Deltoides,	-	-	—





presented by L. Pugh for
illustrating the Utility of
ocular Action.

London, Published as the Act directs Jan 3. 1793 by C Dilly Poultry

Designed & Engraved





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London Published as the Act directs Jan 21 1827 J. C. Dill, Printer



P L A T E II.

*Side View of a WHOLE FIGURE.**Muscles of the Right Side of
the NECK.*

1. Sterno cleido mastoideus, - A.
2. Trachelo mastoideus, - - —
3. Sterno thyroideus, - - —
4. Pterygoideus externus, - R.

*—— of the Left Side of the
NECK.*

5. Sterno cleido mastoideus, - R.
6. Trachelo mastoideus, - - —
7. Trapezeus, - - - E.

—— of the ARM and HAND.

8. Deltoides, - - - E.
9. Coraco brachialis, - - —
10. Biceps flexor cubiti, - - R.
11. Brachialis internus, - - E.
12. Triceps extensor cubiti, - R.
13. Pronator radii teres, - - E.
14. Supinator longus, - - A.
15. Palmaris longus, - - —
16. Extensor digitorum communis, —
17. Anconeus, - - - —
18. Radialis externus, - - E.
19. Ulnaris externus, - - —
20. Abductor pollicis manus, - —
21. Extensor primi internodii, - A.
22. Abductor indicis manus, - E.
23. Prior indicis, - - —
24. ——— medii, - - —
25. ——— annularis, - - —
26. Interosseus auricularis, - —

* Ligamentum carpi annulare expanded, - - —

—— of the TRUNK.

28. Platysma myoides - - E.
29. Pectoralis major, - - —
30. ——— minor, - - —
31. Serratus posterior posticus, - A.
32. ——— inferior posticus, - —
33. Teres major, - - - —
34. Latissimus dorsi, - - —
35. Trapezeus, - - - —
36. Obliquus externus abdominis, E.
37. Transversalis, - - —
38. Quadratus lumborum, - —
- † Intercostrales,* - - A.

* Between the Ribs on each side there are eleven double rows of muscles.

39. Obliquus internus abdominis, E.
40. Recti abdominis. - - —

—— of the LOWER EXTREMITY

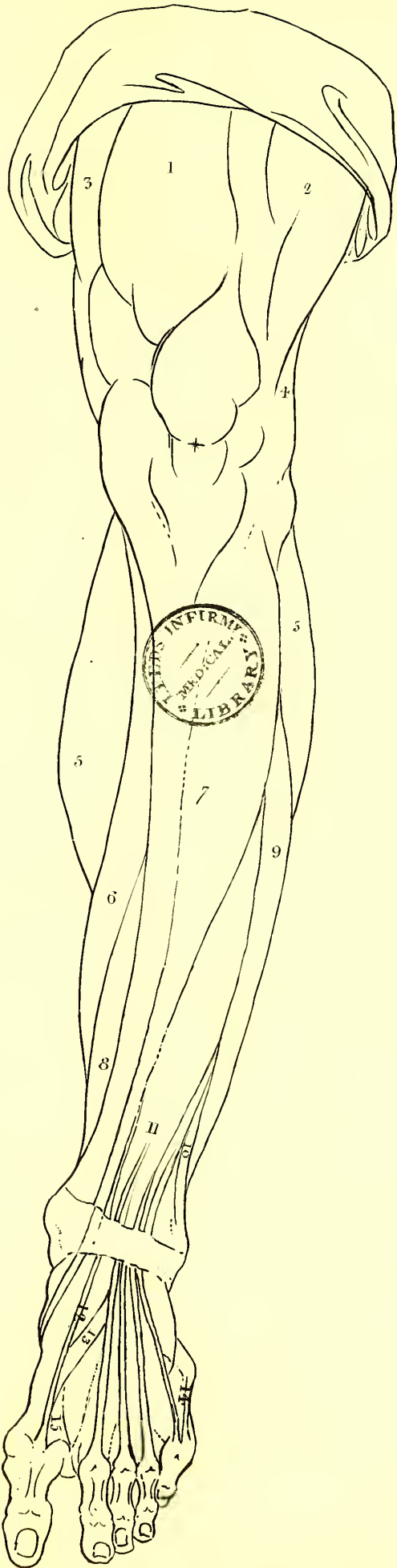
41. Tensor vagina femoris, - A.
42. Gluteus maximus, - - —
43. ——— medius, - - —
44. ——— minimus, - - —
45. Fascialis, - - - E.
46. Rectus femoris, - - A.
47. Vastus externus, - - —
48. Triceps adductor femoris, - A.
49. Cruralis, - - - —
50. Gastrocnemius, - - - R.
51. Soleus, - - - —
52. Peroneus longus, - - E.
53. ——— brevis, - - —
54. Extensor longus digitorum pedis, A.
55. Tibialis anticus, - - E.

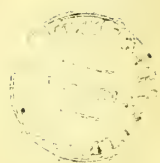
* Ligamentum tarfi annulare expanded.

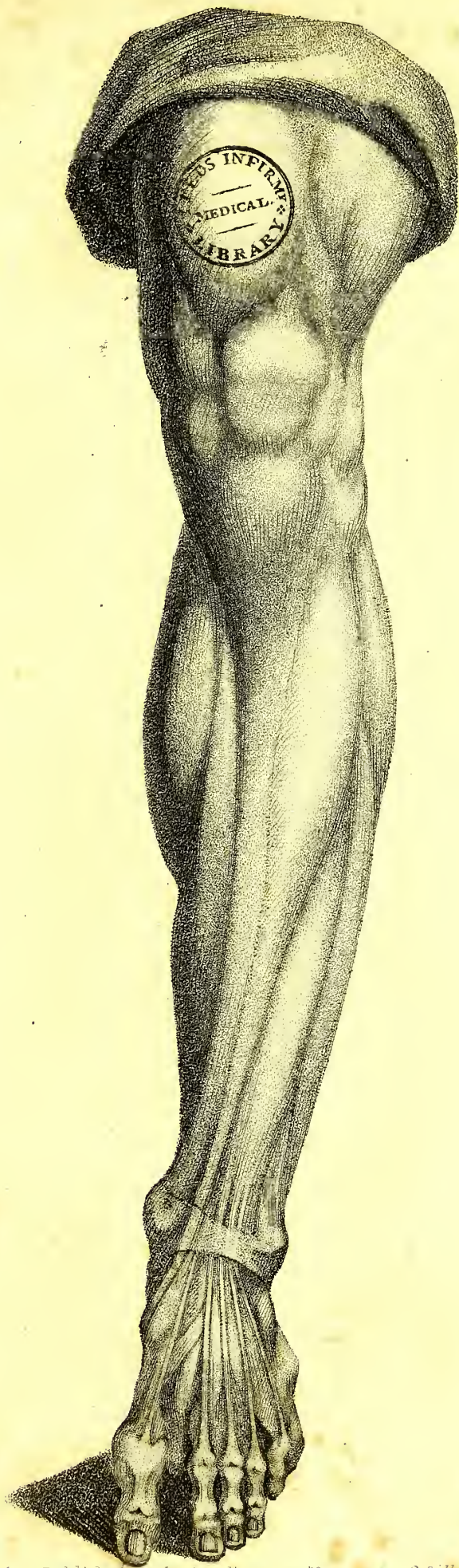
P L A T E III.

Front View of the Muscles of the THIGH, LEG, and FOOT.

1. Rectus femoris,	-	-	A.
2. Vastus externus,	-	-	—
3. ——— internus,	-	-	—
4. Cruralis,	-	-	E.
5. Gastrocnemius,	-	-	A.
6. Soleus,	-	-	—
7. Tibialis anticus,	-	-	E.
8. ——— posticus,	-	-	—
9. Peroneus longus,	-	-	—
10. ——— brevis,	-	-	—
11. Extensor longus digitorum pedis,	—		
12. ——— proprius pollicis pedis,	—		
13. Adductor pollicis pedis.	-		—
14. Abductor minimi digiti pedis,			A.
15. ——— pollicis pedis,	-	-	E.
* Capsular ligament,	-	-	R.







d by J. Fugh, for
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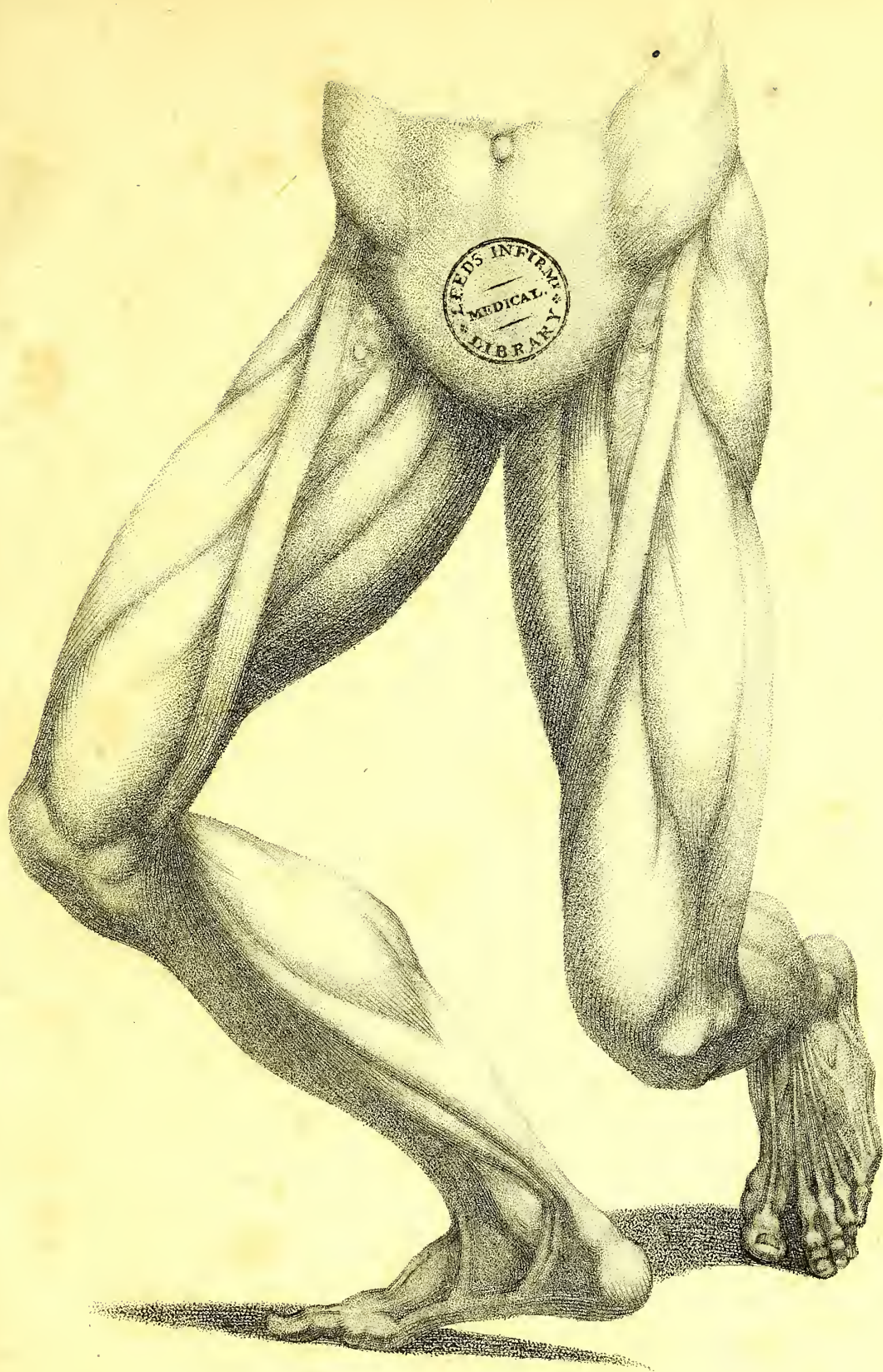
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P L A T E IV.

External View of the THIGH, LEG, and FOOT.

1. Rectus femoris,	-	-	-	R.
2. Vastus externus,	-	-	-	—
3. Cruralis,	-	-	-	E.
4. Semitendinosus,	-	-	-	—
5. Popliteus,	-	-	-	—
6. Gastrocnemius externus,	-	-	-	—
7. Soleus,	-	-	-	—
8. Peroneus longus,	-	-	-	—
9. ————— brevis,	-	-	-	A.
10. Plantaris,	-	-	-	—
11. Tibialis anticus,	-	-	-	—
12. Extensor longus digitorum pedis,	-	-	-	—
13. ————— proprius pollicis pedis,	-	-	-	—
14. Abductor minimi digiti pedis,	-	-	-	E.
15. ————— indicis pedis,	-	-	-	—
* Capsular ligament,	-	-	-	R.
† Annular ligament,	-	-	-	—



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P L A T E VI.

Hind View of the LOWER EXTREMITIES.*Muscles of the* LEFT LIMB.

1. Tensor vagina femoris,	-	-	-	A.
2. Fascialis,	-	-	-	—
3. Rectus femoris,	-	-	-	—
4. Gluteus maximus,	-	-	-	—
5. ——— medius,	-	-	-	—
6. ——— minimus,	-	-	-	—
7. Triceps adductor femoris,	-	-	-	—
8. Cruralis,	-	-	-	A.
9. Vastus externus,	-	-	-	—
10. Semitendinosus,	-	-	-	—
11. Gastrocnemius,	-	-	-	—
12. Soleus,	-	-	-	—
13. Tendo Achillis,	-	-	-	—
14. Peroneus longus,	-	-	-	E.
15. ——— brevis,	-	-	-	—
16. Extensor longus digitorum pedis,	-	-	-	—
17. Abductor minimi digiti pedis,	-	-	-	A.
* Annular ligament expanded,	-	-	-	—

———— of the RIGHT LIMB.

18. Glutei,	-	-	-	R.
19. Semitendinosus,	-	-	-	E.
20. Semimembranosus,	-	-	-	—
21. Triceps adductor femoris,	-	-	-	—
22. Cruralis,	-	-	-	—
23. Gracilis,	-	-	-	A.
24. Popliteus,	-	-	-	—
25. Gastrocnemius,	-	-	-	E.
26. Soleus,	-	-	-	—
27. Tendo Achillis,	-	-	-	—
28. Peroneus brevis,	-	-	-	A.
29. Tibialis posticus,	-	-	-	—

P L A T E VII.

*Front View of the TRUNK of the Body, with Part of the
ARMS and THIGHS.**Muscles of the NECK and TRUNK.*

1.	Sterno thyroideus,	-	-	-	E.
2.	—— cleido mastoideus,	-	-	-	—
3.	Pectoralis major,	-	-	-	R.
4.	—— minor,	-	-	-	—
5.	Teres major,	-	-	-	E.
6.	—— minor,	-	-	-	—
‡	Platyfma myoideus.				
8.	Serratus magnus,	-	-	-	A.
9.	—— posticus inferior,	-	-	-	—
10.	Obliquus externus abdominis,	-	-	-	E.
11.	Transversalis,	-	-	-	—
12.	Latissimus dorsi,	-	-	-	—
13.	Quadratus lumborum,	-	-	-	—
14.	Rectus abdominis,	-	-	-	—
15.	Intercostales,	-	-	-	A.

—— of the THIGH.

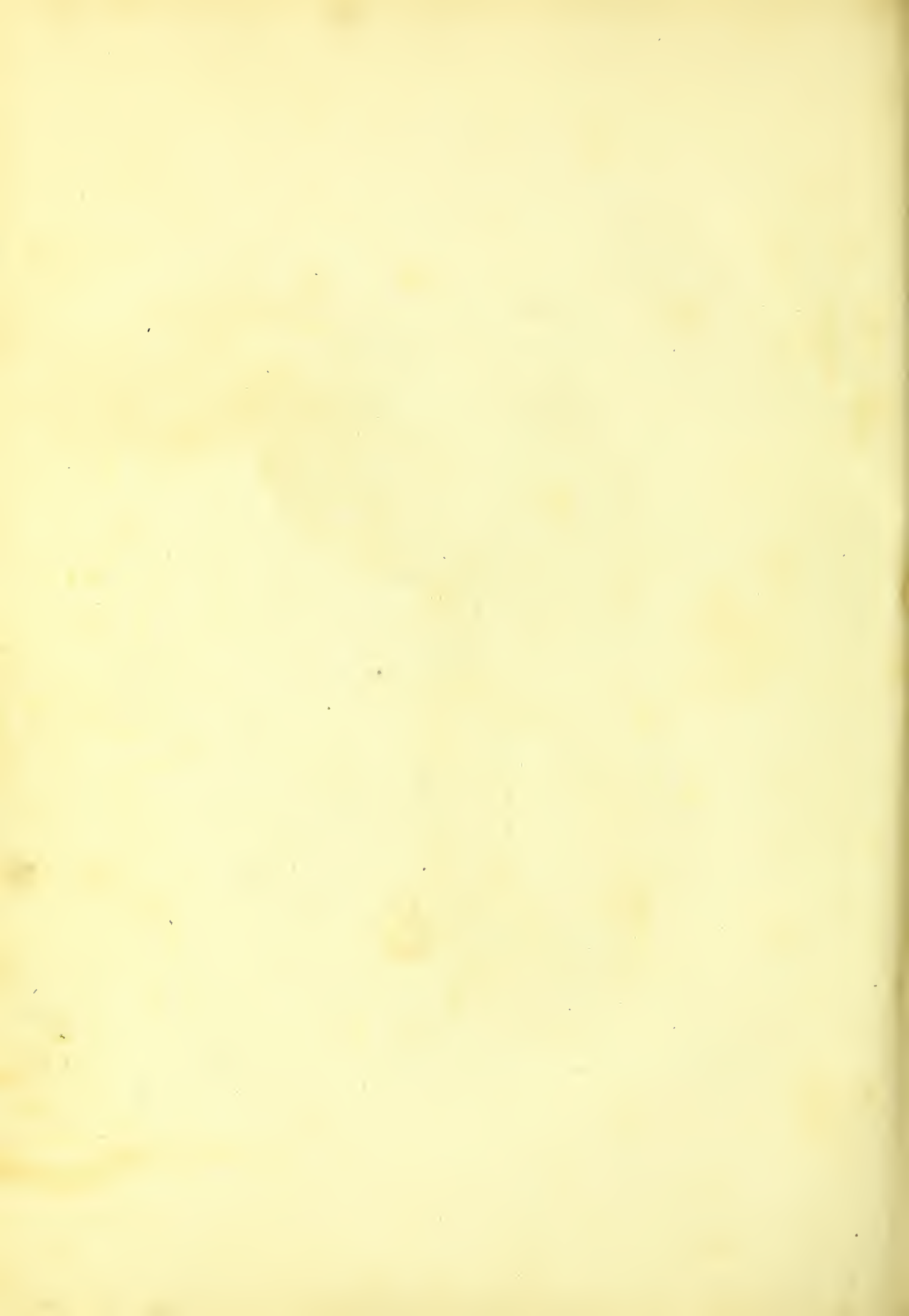
16.	Gluteus maximus,	-	-	-	A.
17.	—— medius,	-	-	-	—
18.	—— minimus,	-	-	-	—
19.	Tenfor vagina femoris,	-	-	-	E.
20.	Fascialis,	-	-	-	—
21.	Sartorius,	-	-	-	—
22.	Rectus femoris,	-	-	-	—

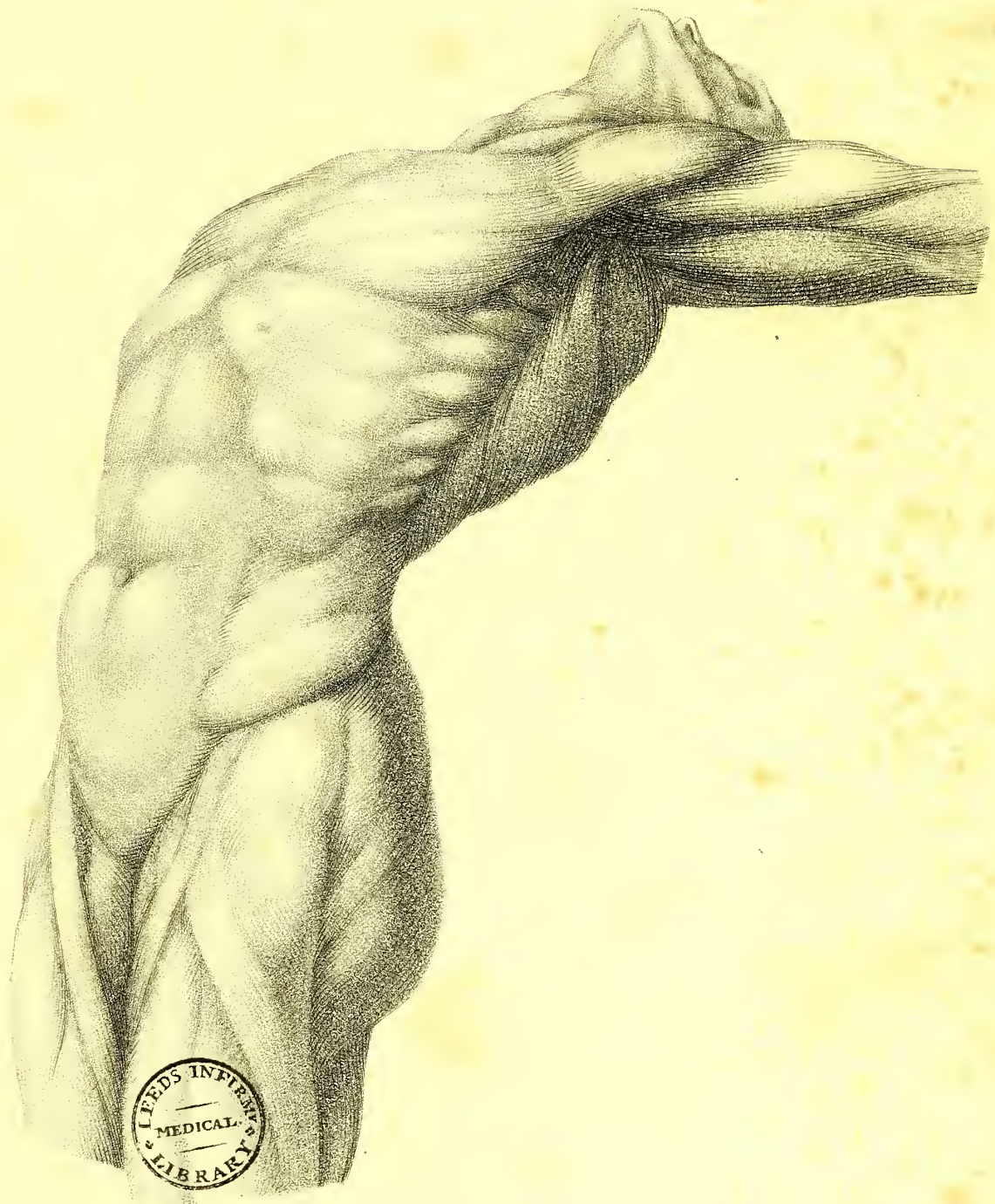
—— of the ARMS and SIDE.

23.	Deltoides,	-	-	-	A.
24.	Brachialis externus,	-	-	-	—
25.	Biceps flexor cubiti,	-	-	-	R.

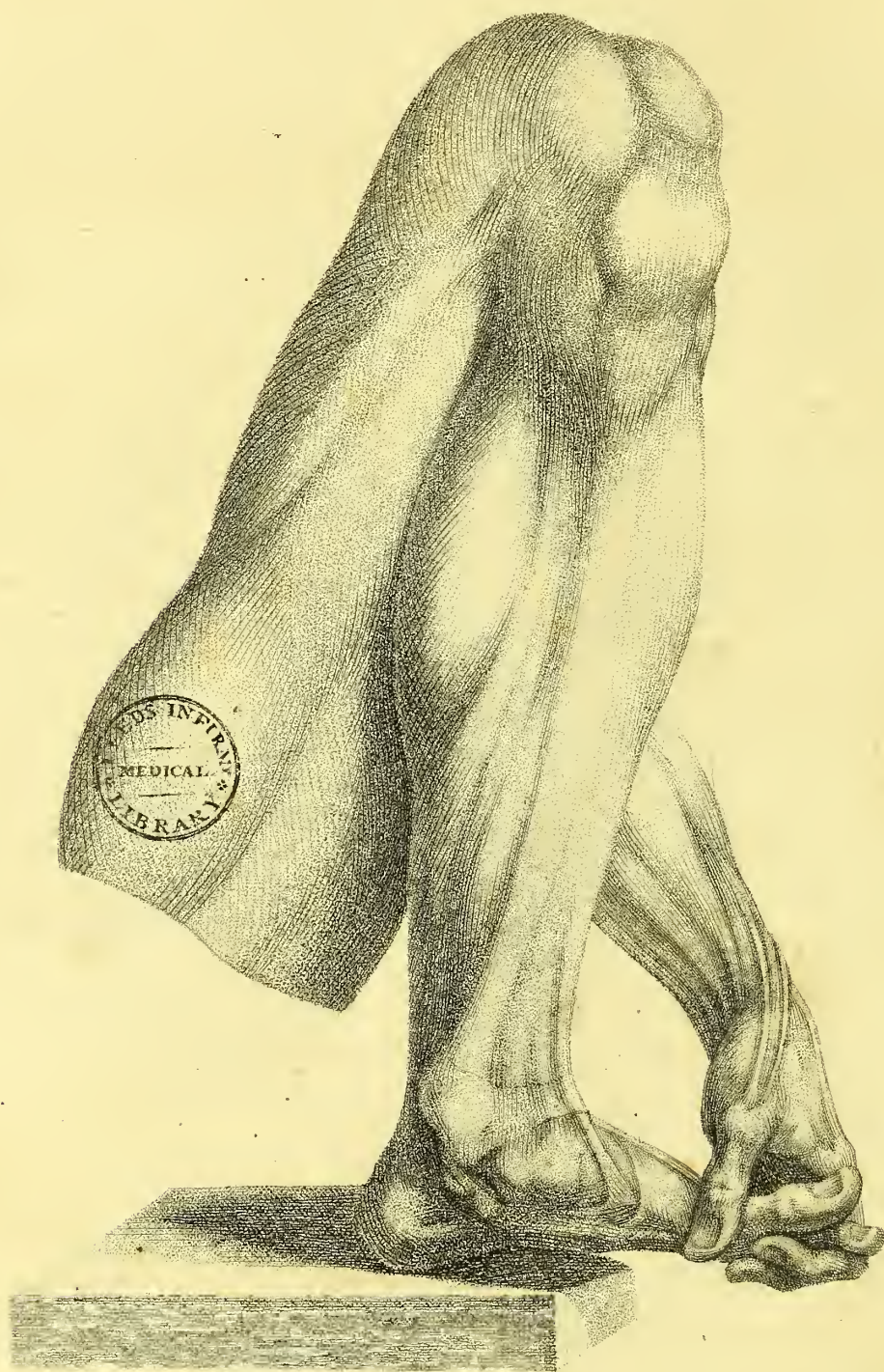
‡ The Platyfma myoides (Plate I. No. 10, and Plate II. No. 28.) is dissected off along with the skin, in order to shew the more important muscles.







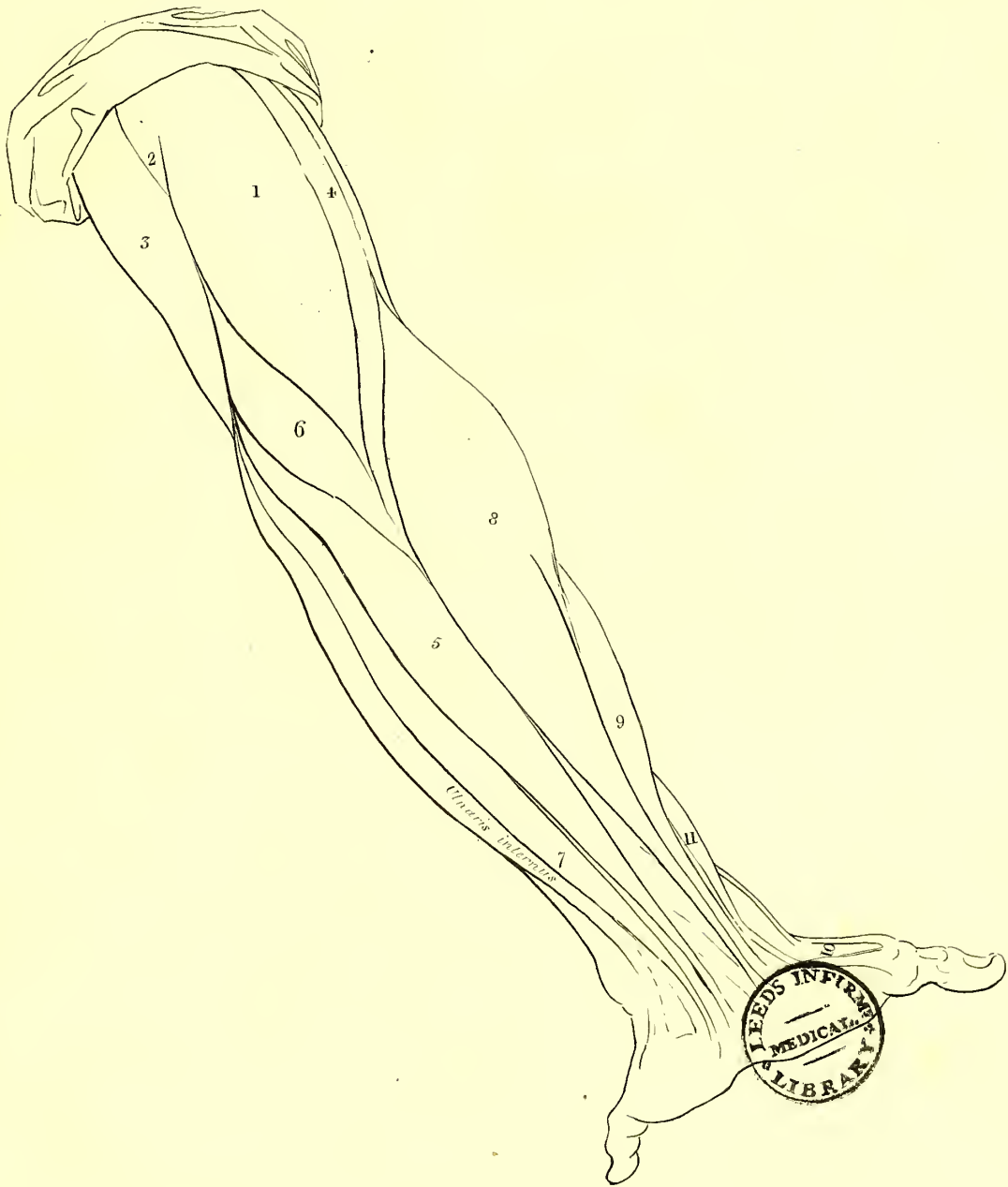




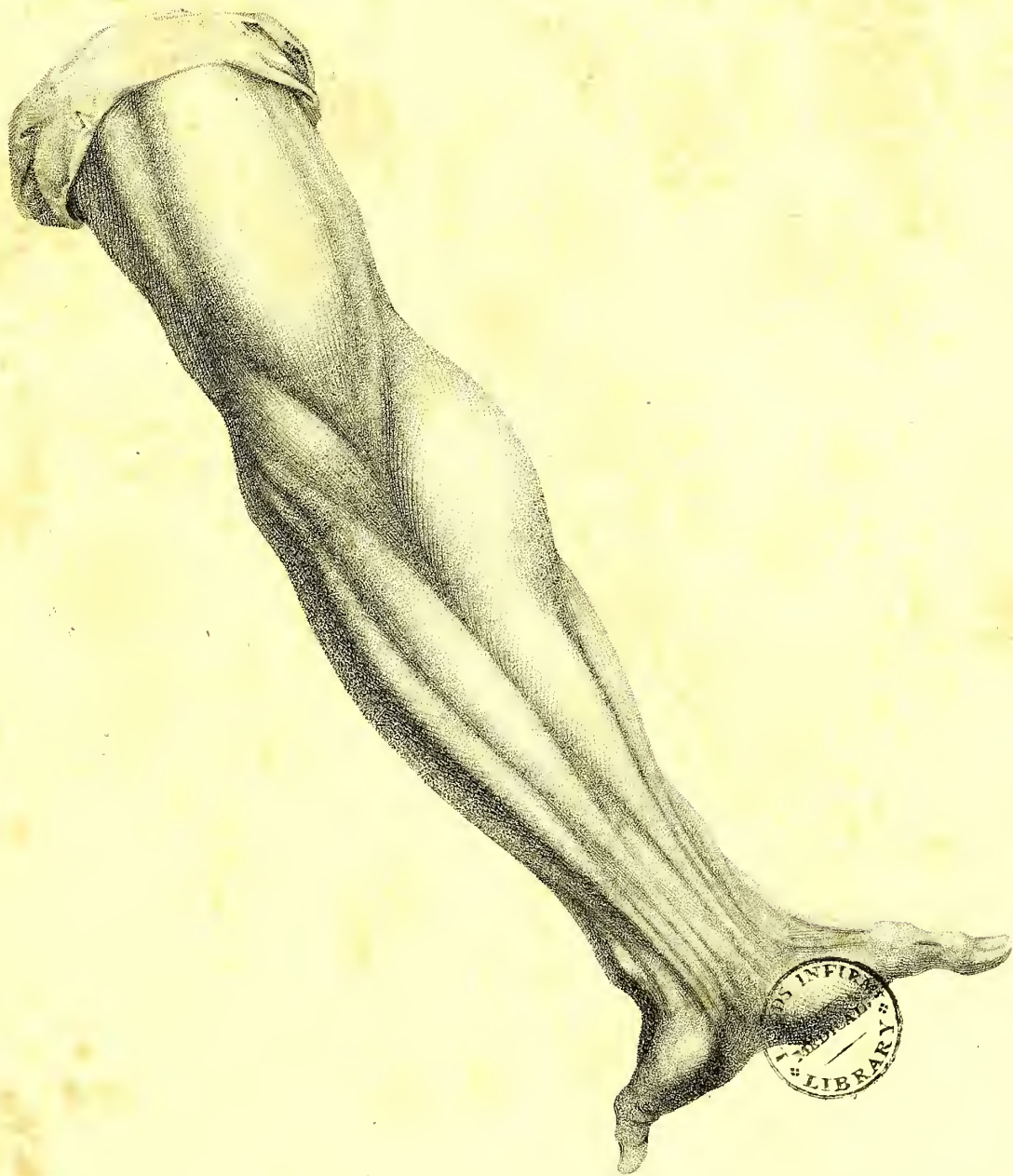
P L A T E IX.

Internal View of the Muscles of the FORE ARM.

1. Biceps flexor cubiti,	-	-	R.
2. Brachialis internus,	-	-	—
3. Anconeus,	-	-	—
4. Pronator radii teres,	-	-	E.
5. Palmaris longus,	-	-	—
6. ————— brevis,	-	-	—
7. Sublimis,	-	-	—
8. Supinator radii longus,	-	-	A.
9. Radialis internus,	-	-	E.
10. Extensor primi internodii,	-	-	A.
11. Abductor pollicis manus,	-	-	—





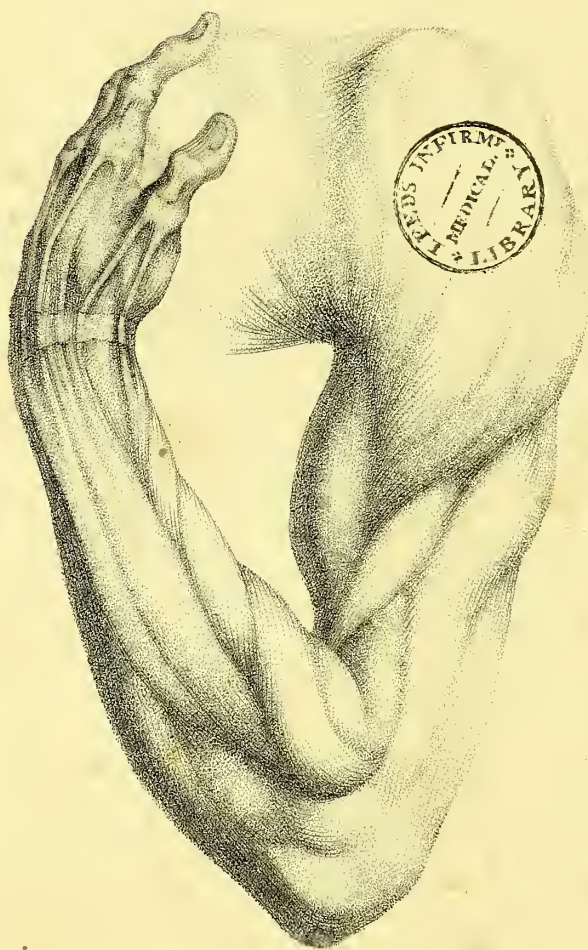


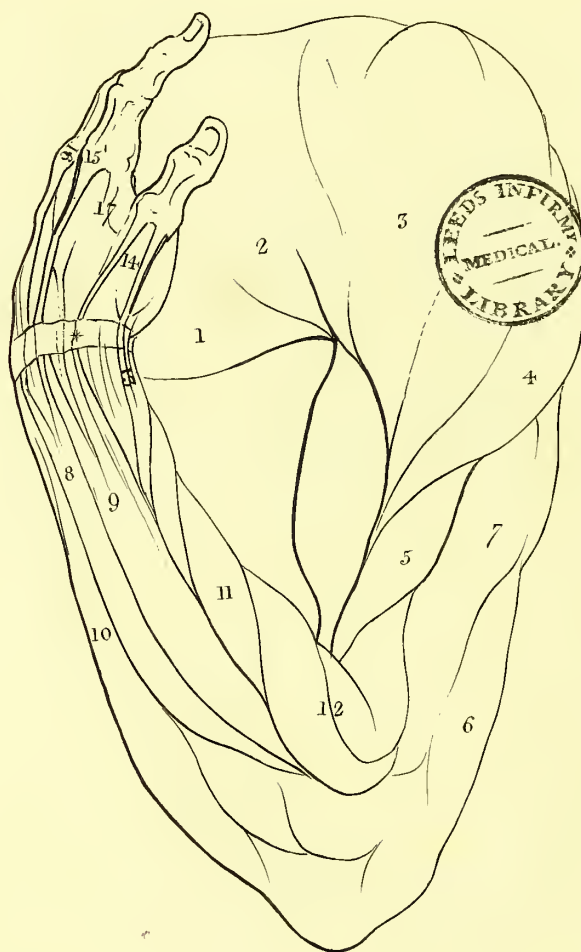
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Dissected in the Anatomical Hall of the University of Cambridge







P L A T E X.

External View of the Muscles of the LEFT ARM bent.

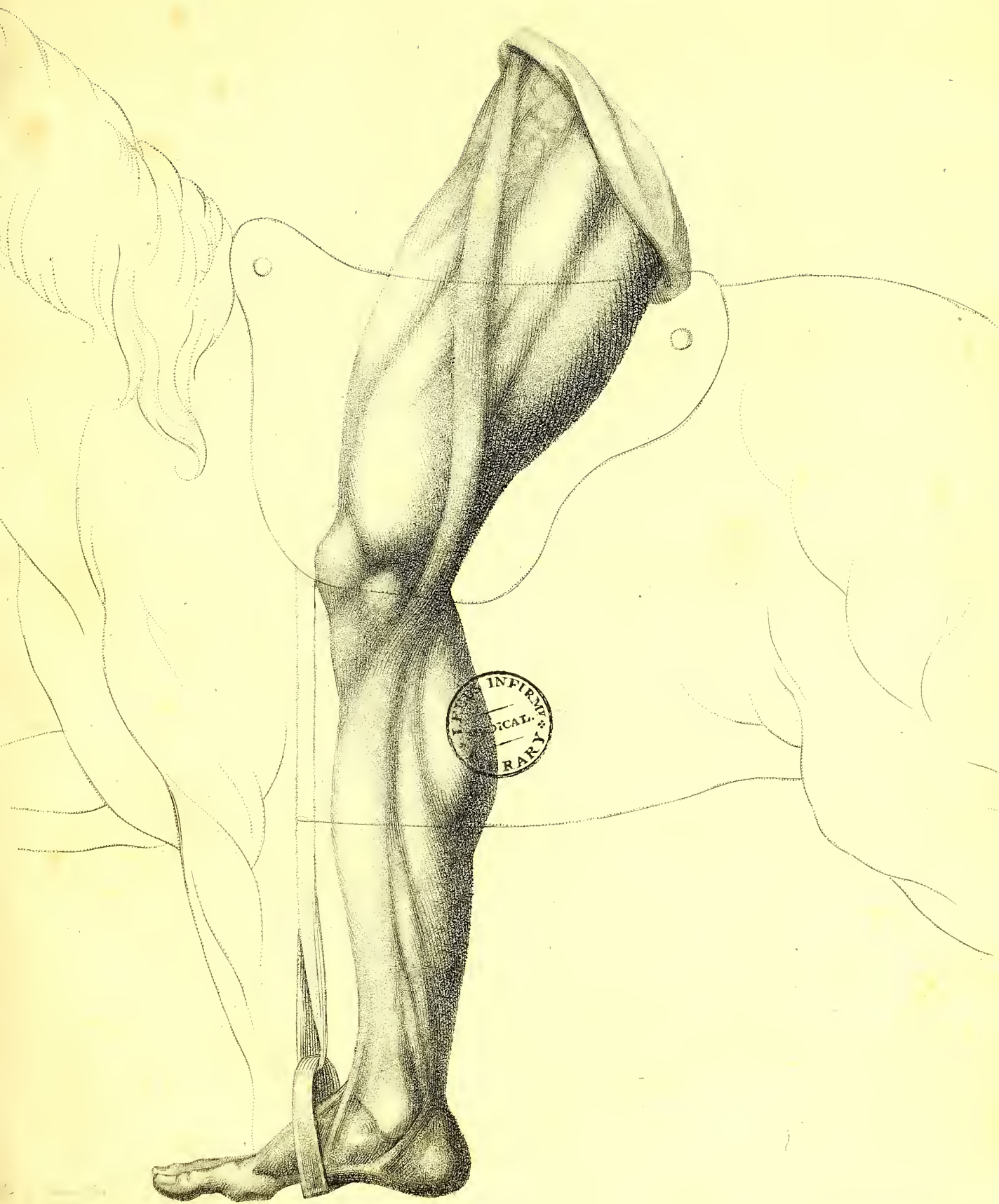
1. Pectoralis major,	-	-	R.
2. ——— minor,	-	-	—
3. Deltoides,	-	-	—
4. Coraco brachialis,	-	-	E.
5. Brachialis internus,	-	-	A.
6. Anconeus,	-	-	—
7. Triceps extensor cubiti,	-	-	E.
8. Extensor digitorum communis,	-	-	—
9. Radialis externus,	-	-	—
10. Ulnaris externus,	-	-	—
11. Radialis internus,	-	-	A.
12. Supinator longus,	-	-	—
13. Abductor pollicis manus,	-	-	—
14. Extensor primi internodii,	-	-	E.
15. Prior indicis,	-	-	—
16. ——— medii,	-	-	—
17. Abductor indicis manus,	-	-	A.
* Annular ligament,	-	-	E.

P L A T E X I.

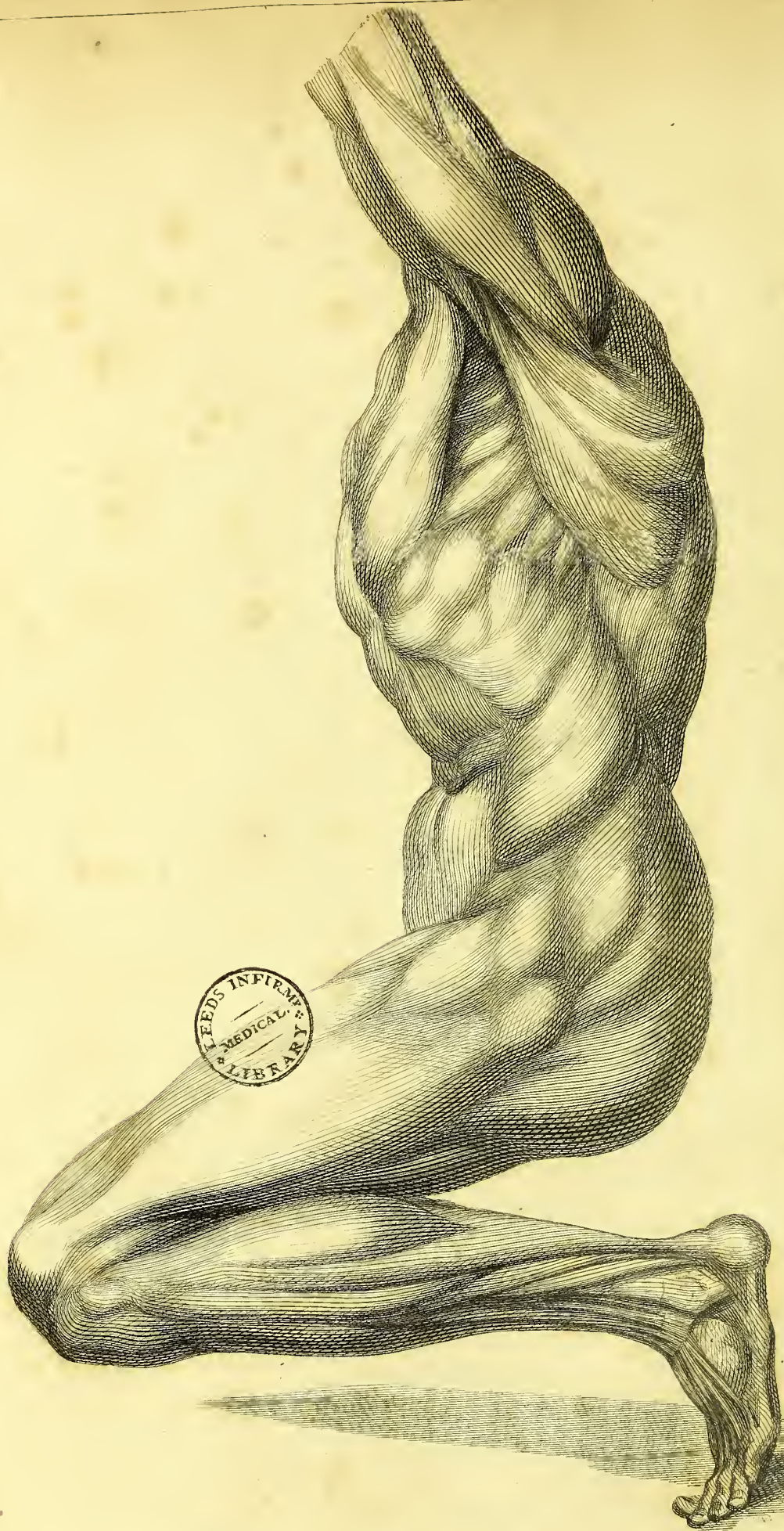
*Internal View of the Muscles of the RIGHT THIGH and LEG,
As they appear compressed against the Right Side of the Saddle.*

1. Gracilis,	-	-	-	R.
2. Triceps adductor femoris,	-	-	-	—
3. Pectinalis,	-	-	-	—
4. Sartorius,	-	-	-	—
5. Psoas magnus,	-	-	-	—
6. Iliacus internus,	-	-	-	—
7. Tensor vagina femoris,	-	-	-	—
8. Rectus femoris,	-	-	-	A.
9. Vastus internus,	-	-	-	R.
10. Gastrocnemius,	-	-	-	—
11. Soleus,	-	-	-	E.
12. Tibialis anticus,	-	-	-	A.
13. ——— posticus,	-	-	-	E.
14. Plantaris,	-	-	-	—
15. Extensor proprius pollicis pedis,	-	-	-	A.
16. Flexor longus digitorum pedis,	-	-	-	E.
17. Tendo Achillis,	-	-	-	—
* Capsular ligament,	-	-	-	R.









Drawn by Kirk. Eng.

Engraved by F. Pugh, Sc.
Illustrating the Utility of
Muscular Action

Engraved from the original drawing by J. B. Kirk, Esq. in 1840.



P L A T E XII.

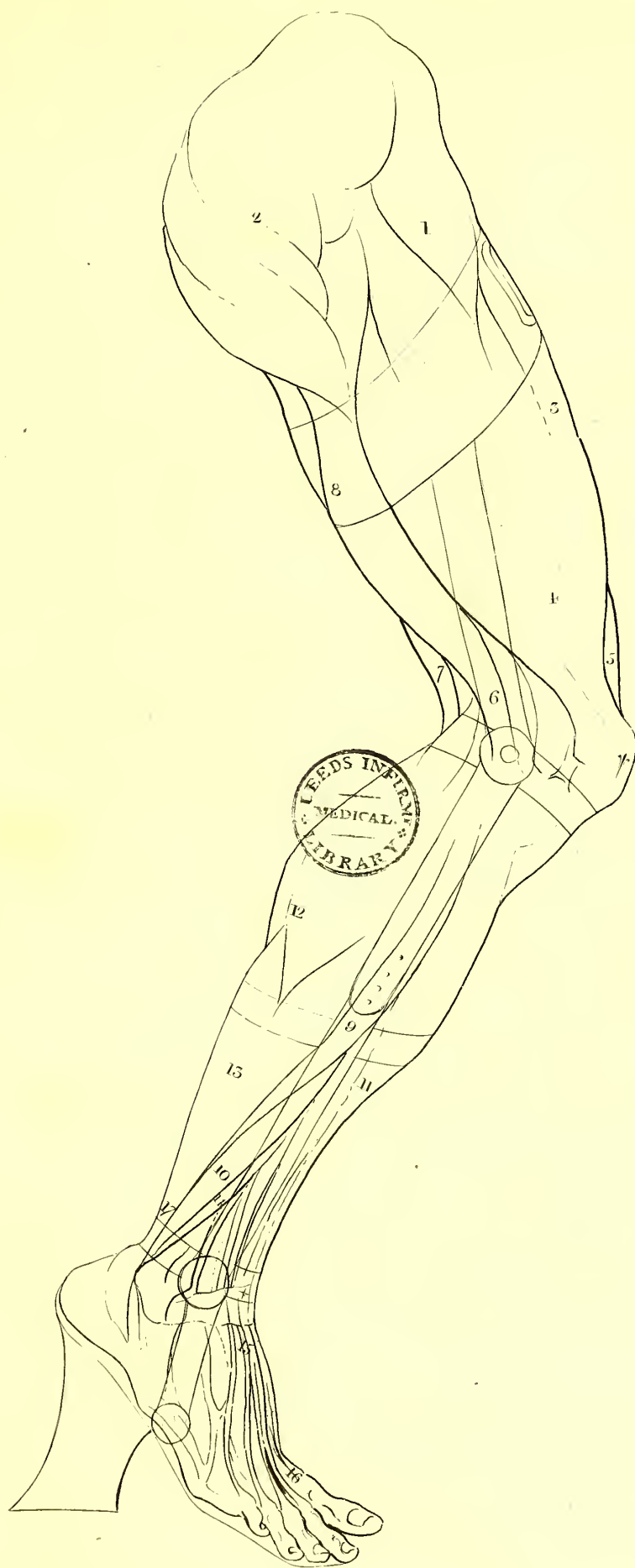
*External View of the LOWER EXTREMITY, TRUNK, with
Part of the ARM.*

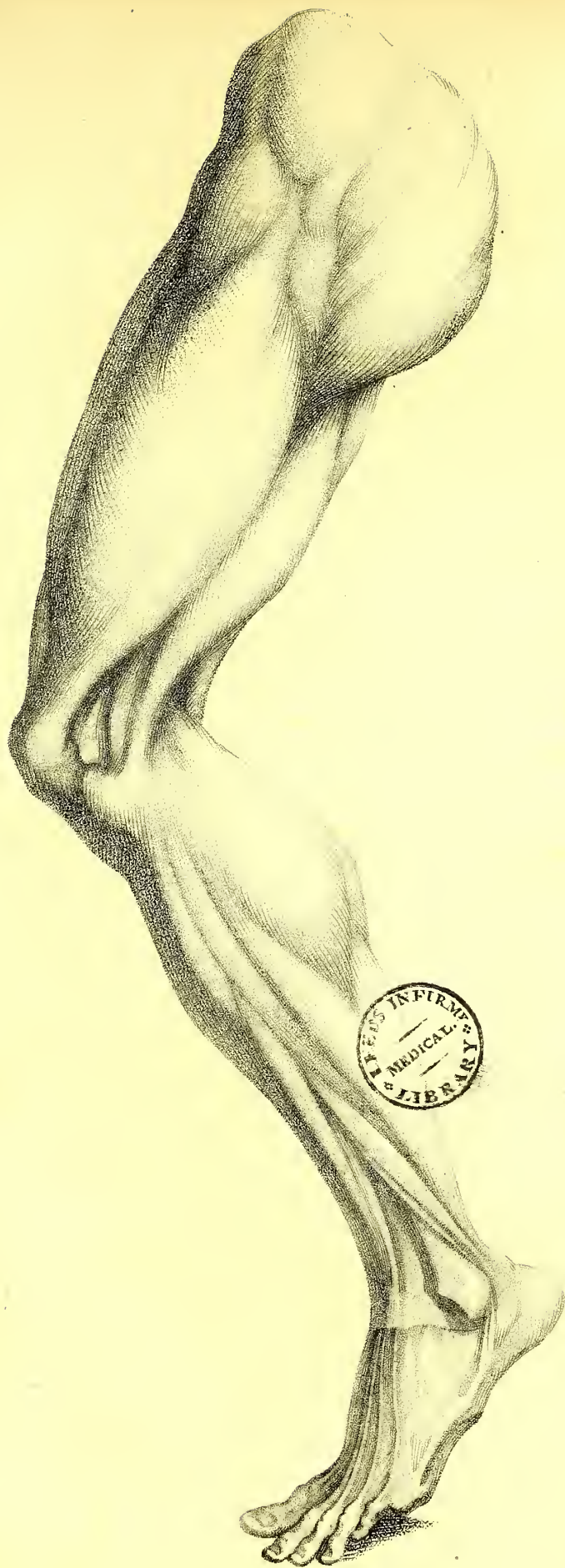
1. Brachialis externus,	-	-	-	-	E.
2. Anconeus,	-	-	-	-	—
3. Biceps flexor cubiti,	-	-	-	-	R.
4. Coraco brachialis,	-	-	-	-	A.
5. Deltoides,	-	-	-	-	—
6. Teres major,	-	-	-	-	R.
7. ——— minor,	-	-	-	-	—
8. Supra spinatus,	-	-	-	-	A.
9. Pectoralis major,	-	-	-	-	R.
10. ———— minor,	-	-	-	-	—
11. Serratus magnus,	-	-	-	-	A.
12. ——— posticus inferior,	-	-	-	-	—
13. Latissimus dorsi,	-	-	-	-	—
14. Obliquus externus abdominis,	-	-	-	-	E.
15. Quadratus lumborum,	-	-	-	-	—
16. Rectus abdominis,	-	-	-	-	—
17. Obliquus internus,	-	-	-	-	E.
18. Intercostales,	-	-	-	-	A.
19. Tensor vagina femoris,	-	-	-	-	—
20. Glutei,	-	-	-	-	—
21. Fascialis,	-	-	-	-	—
22. Sartorius,	-	-	-	-	—
23. Rectus femoris,	-	-	-	-	E.
24. Vastus externus,	-	-	-	-	—
25. ——— internus,	-	-	-	-	—
26. Biceps cruris,	-	-	-	-	A.
27. Triceps adductor femoris,	-	-	-	-	R.
28. Gastrocnemius,	-	-	-	-	—
29. Soleus,	-	-	-	-	—
30. Peroneus longus,	-	-	-	-	A.
31. ——— brevis,	-	-	-	-	E.
32. Extensor longus digitorum pedis,	-	-	-	-	A.
33. ——— proprius pollicis pedis,	-	-	-	-	—
34. Tendo Achillis,	-	-	-	-	R.
35. Abductor minimi digitis pedis,	-	-	-	-	
* Annular ligament,					
† Capsular ligament.					

P L A T E XIII.

View of the MUSCLES, in the state in which they remain from the dangerous Habit of wearing HIGH-HEELED SHOES ; and also when compressed with IRONS.

1. Tenfor vagina femoris,	-	-	A.
2. Gluteii,	-	-	—
3. Rectus femoris,	-	-	—
4. Vastus externus,	-	-	—
5. ——— internus,	-	-	—
6. Cruralis,	-	-	—
7. Semitendinosus,	-	-	—
8. Triceps adductor femoris,	-	-	R.
9. Peroneus longus,	-	-	A.
10. ——— brevis,	-	-	E.
11. Tibialis anticus,	-	-	—
12. Gastrocnemius,	-	-	A.
13. Soleus,	-	-	—
14. Plantaris,	-	-	—
15. Extensor longus digitorum pedis,	-	-	—
16. ——— proprius pollicis pedis,	-	-	—
17. Tendo Achillis,	-	-	—
† Capsular ligament,			
* Annular ligament.			

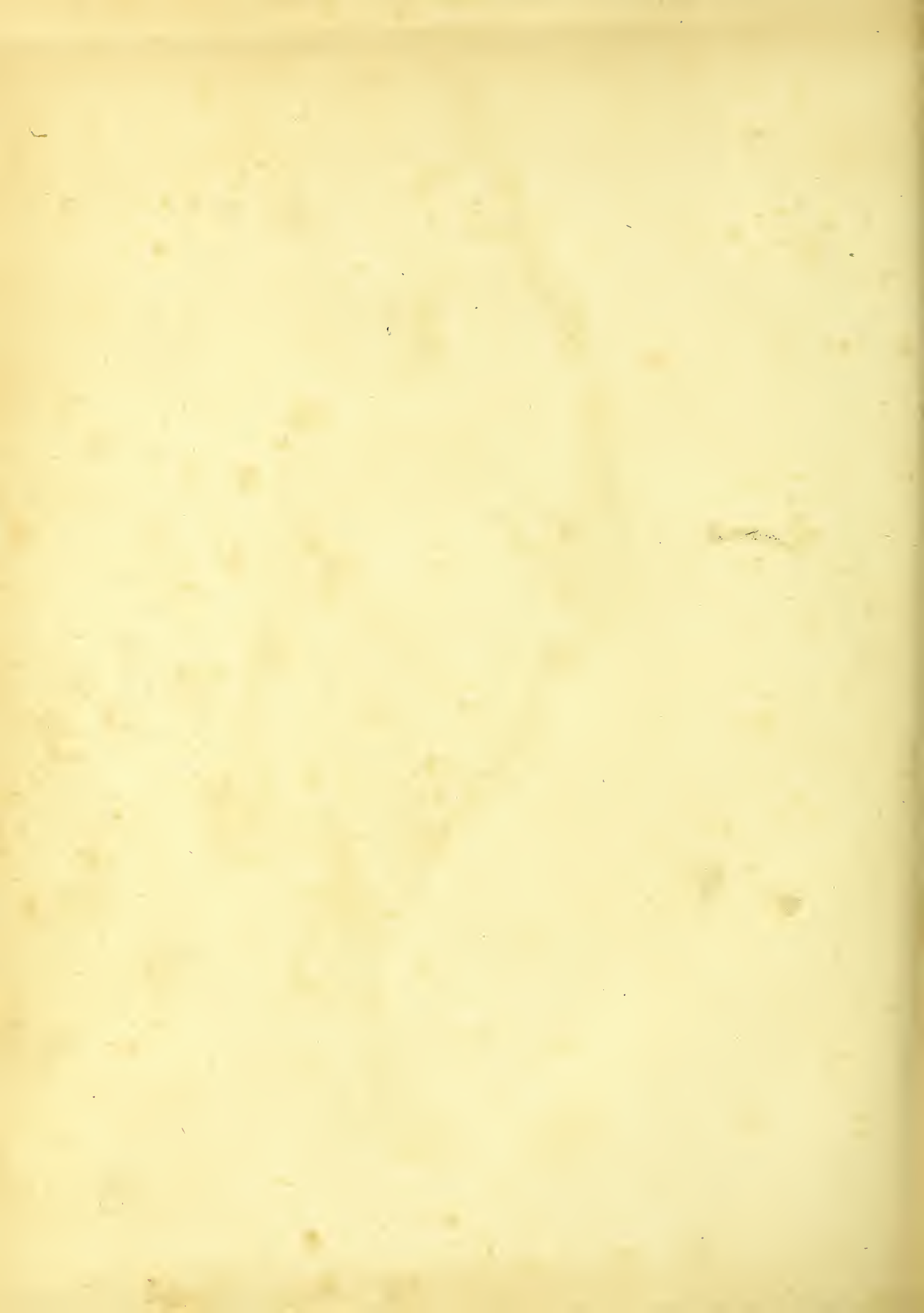


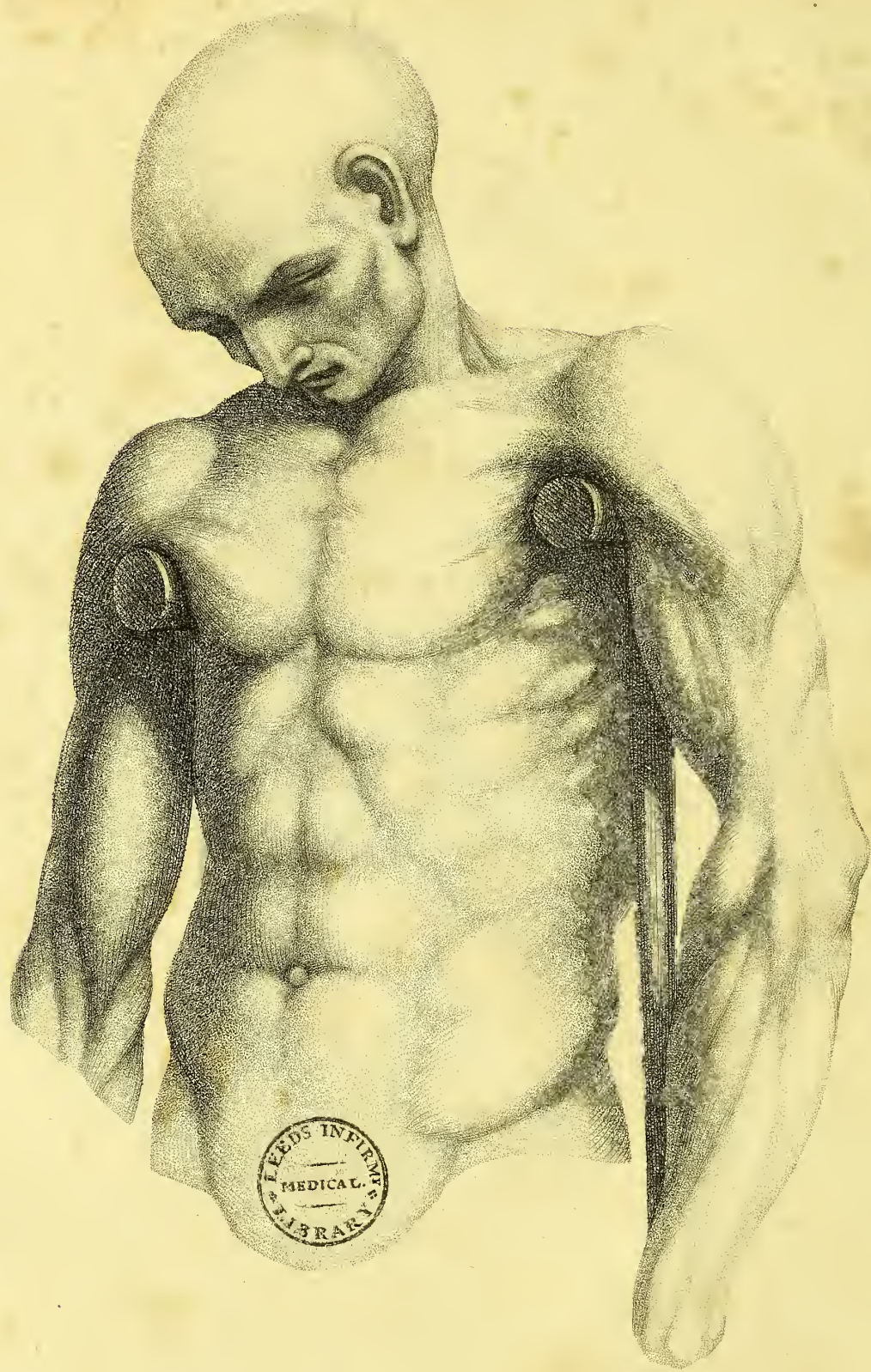


by J. Payne 1807
The Utility of
Action

London: Printed and sold by the Author, at No. 1, St. James's Street, near the Strand, 1807.

James A. Esq. and Dr. J.





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P L A T E X I V .

*View of the MUSCLES of the Body in a passive state, proving
the dangerous Effects of leaning on CRUTCHES.*

1. Mastoideus,
2. Trapezeus,
3. Pectoralis major,
4. ——— minor,
5. Serratus magnus,
6. ——— posticus inferior,
7. Latissimus dorsi,
8. Obliquus internus,
9. ——— externus,
10. Rectus abdominis,
11. Intercostales,
12. Deltoides,
13. Biceps flexor cubiti,
14. Brachialis internus,
15. Triceps extensor cubiti,
16. Supinator longus,
17. Palmaris longus,
18. Radialis externus,
19. Ulnaris externus,

N. B. The muscles compressed by the use of Crutches; see the Arm-pit,
Plate XII. No. 1, 2, 3, 4, 5, 6, 7, 8, and 10.

C H A P. VI.

MADE acquainted, as we have been in the foregoing part of this work, with the nature of a muscle, its properties, and uses, respecting its power of motion, and by what means these were created, it will now be necessary to say something on the other moving powers of the machine which are connected with the muscles, as those powers are influenced very often, in a great degree, by muscular action; and it is frequently from this action upon them that great benefit is derived to the machine in general, and many chronic affections alleviated and cured.

The **BLOOD**, that universal vivifying and nutritious fluid, which circulates to every minute part of the machine, is conducted to the heart by the large artery of the body called **AORTA**, and its ramifications; which ramifications, after they are arrived at their smallest series, anastomose, or are united with the very minute branches of the veins; which uniting with larger and larger branches in their progress at last terminate in the heart, forming the large vein of the body named **VENA CAVA**—so that by this connection of the arteries and veins there arises a kind of circle, as it were, for the efflux of the blood from, and its reflux to, the heart, which gives us the idea of the circulation.—Thus, then, we consider the aorta dividing itself into smaller and smaller ramifications

forming the origin of the arteries—and the minute branches of the veins uniting into larger and larger branches, forming the origin of the veins.

Now these ramifications are dispersed every where over the human machine, and run in various directions along the interstitial parts of the muscles, and as they move along, send branches into the portions of the muscles themselves, as we see obviously by the red colour of the muscular fibres.

These arteries and veins are accompanied for the most part with branches of nerves, which are continuations from different parts of the brain, medulla oblongata, and spinal marrow, and are considered as the fountain and instrument of all perception and sensation, as well as parts by the continuance of whose action all motion is maintained.—Besides, there are another series of vessels which are associates with these, termed absorbents, or lymphatics, which originate from surfaces, and cavities, and absorbing fluids, which may be placed on these surfaces or cavities, and carry them also into the mass of blood—And we know, for the well-being of the animal the fluids should be carried through the course of circulation with proper force, quickness, and equability.

Being now in possession of these principles, it is incumbent on us to inquire how they conjunctively act, to produce proper effect one upon the other, as by those means, being informed of what constitutes the healthful stamina, we shall be better able to judge what remedies ought to be applied in cases of

morbid affections, and then see how far muscular exercise quadrates with these particulars.

Now we know that a muscle, to be in an healthful state, must be possessed of proper degrees of contractility, elasticity, and distension—capable of feeling the impressing power of nervous influence—and of exercising the inherent power peculiar to itself, (pag. 34, 35, &c.); so long, therefore, as it possesses these properties in due proportions, so long is it capable of performing all its actions in an healthful manner, and of continuing them, if the nervous influence is exerted with regularity and equability—But if these powers become too much augmented—decreased—or totally lost—any one or all of them—or if the nervous influence should be too strong—defective—irregular, or altogether destroyed—then shall we have morbid muscular action, or a total deprivation as the unavoidable consequences—as may be instanced in some convulsions, cramps, pains, contractions, relaxations, debilities, palsies, &c. &c.—Besides, these effects will be made more severe and more permanent by the increase or decrease of the circulatory powers, whence the fluids will be pushed forwards too rapidly, or too tardily, perhaps stagnate, and have their particular properties altered from an healthful to a morbid state—whereby a variety of diseases may not only be locally, but more universally generated through the habit—as an example we will take the Gout.

This we consider to arise from a humor, said to be by physicians, *sui generis*, that is, peculiar, and differing in its

nature from any other with which we are acquainted, as is that of the small-pox, measles, &c. producing specific diseases, which originate not from any other source. This humor, either inherent, or generated in the habit, when it begins to exert itself, has the elective power of fixing itself upon parts contiguous to the small joints of the body—most commonly those of the feet, whence its name *PODAGRA*, from the Greek words *pous*, pes, the foot, and *agra*, captura, a seizure or affection—this humor fixing there, or in the ankle or knee, creates by its pungency great pain, by which the fluids are solicited into those and the contiguous parts with great freedom; whence the vessels, even the minutest, become filled and distended, and the cellular membrane also, as well as those of the skin, occasioning swelling and inflammation of the parts, which will be large in proportion to the violence and continuance of the offending stimulus.—Hence, when the stimulus of the gouty matter ceases, there remains other causes of pain, occasioned by the fullness and distension of the vessels, and of some muscular parts also being left in a state of too great irritability and weakness, by which great pain is felt on slight motion, and very often from different positions of the parts first affected, or those which are contiguous. This being the case, patients are afraid of motion, and solicitously keep the limb in an inactive state, and so placed as to render it easy to themselves, which is generally in a bent posture. This, therefore, produces too great and too long extension of the muscles and tendons on one part, whence the elastic as well as contractile power is debilitated, the vessels on the parts rendered straighter, and the fluids

prohibited from circulating with proper force through their cavities—whilst the muscles and tendons, on the opposite side, have their elasticity and contractility increased—the vessels distended from too great fullness, and the fluids, from the weakness of the vascular coats induced, slowly moving through, or stagnating in their cavities; hence will come on infarction or obstruction, thickening of the coats of the fibres, lacerti and lacertuli of the muscles and tendons, whence congestions of the fluids, contractions, rigidity, inability to motion, and lameness—and these made perpetual by inactivity—hence also those indurated substances called chalk stones; on which subject we shall give the opinion of Sydenham:

“ Chalky concretions are considerably increased in the
 “ joints, and especially in the fingers, by long inaction, so
 “ that at length these parts quite lose their motion: for,
 “ however positively some may assert, that the matter of
 “ these concretions is only the tartar of the blood trans-
 “ lated to the joints, it will nevertheless easily appear, upon
 “ considering the thing with a little more attention, that
 “ when a large quantity of indigested gouty matter falls
 “ upon some of the joints, and occasions a lasting swelling of
 “ the neighbouring parts, it happens at length, partly from
 “ their assimilating property being destroyed, and partly from
 “ the obstruction caused therein by this sluggish humor, that
 “ this matter is generated, which is changed into this kind
 “ of substance by the heat and pain of the joint, and in-
 “ creases every day, converting the skin and flesh of the

“ joint into its own nature, and may be picked out with a
 “ needle, and resembles chalk, crab’s eyes, or some such
 “ fimilar fubftance.

“ But I have experienced in my own particular cafe, that
 “ not only the generation of thefe concretions may be pre-
 “ vented by daily and long-continued exercife, which duly
 “ diftributes the gouty humor through the whole body, that
 “ otherwife readily attacks a particular part, but it alfo dif-
 “ folves old and indurated concretions, provided they be not
 “ come to fuch a degree, as to change the external fkin into
 “ their fubftance.” WALLIS’S SYDENHAM, vol. ii. p. 238.

Though every dependence is to be had on the facts recited by SYDENHAM refpe&ing their truth, yet he appears fometimes not fo clear in his fpeculative ideas; and in this cafe, with regard to the nature of what he calls chalk-ftones, we cannot avoid thinking him guilty of an error—He confiders thefe gouty concretions as matter forming the gout, and depofited in thefe places;—but fome experiments prove them only to be the earthy fubftance which forms the bafis of the bones, which will be found recited by VAN SWIETEN, where it is proved, that the cretaceous fubftance found in and near the gouty joints, have the fame properties of the earthy matter which forms the bone.

Speaking of the formation of bones,—“ cartilage,” fays he, “ differs from bone, becaufe it is not that earthy fub-

“ stance—and if by macerating bone in an acid that earthy
 “ matter will be removed, the cartilage re-appears :—if that
 “ earthy matter should be coloured, as it will be by feeding
 “ the animal on madder root, the bone being macerated in
 “ acid, the coloured part will be destroyed, and the cartilage
 “ remain untinged.” HERISSART hath observed, “ that
 “ gouty concretions dissolve entirely in nitrous acid, leaving
 “ behind neither cartilage nor membrane.—The same was
 “ observed in an old woman, who had in her toes similar
 “ gouty concretions, for after using madder root the concre-
 “ tions were tinged of a saturated red colour, and dissolved
 “ entirely in a dilute acid—Hence it is conclusive, that the
 “ ossific matter may be tinged by taking the root of madder,
 “ and seeing that gouty concretions consist of this earthy
 “ substance, they are struck with a deeper colour than the
 “ bones themselves.”—From which, joined with some other
 experiments tending to prove the same point, he concludes,

“ If, therefore, from repeated attacks of the gout, the
 “ vessels shall be so changed, if the fabric of the bones
 “ should be so injured, that which had been destined for the
 “ reparation of the bone cannot arrive at the proper place,
 “ it seems probable, that the same matter deposited in the
 “ parts contiguous, constitutes the gouty concretions, or
 “ chalk-stones :—for it has before been proved, that they
 “ have the same properties which are found in the earthy
 “ parts of the bone, and which, added to cartilage, form
 “ bone.”

“ Therefore, where this matter destined for the necessary
 “ reparation of bone is collected within the cavities of the
 “ joints, it creates stiff joints, scarce ever recoverable—if it
 “ seizes the ligaments, it destroys their flexibility—and thus
 “ takes away both the motion and use of the parts, and
 “ occasions there different species of deformities—sometimes
 “ distorting one or more fingers, making them like a bundle
 “ of parsnip roots, and depriving them of motion gradually.”
 VAN SWIETEN's Comment. in Boerhaavii Aphor. 4to. vol. iv.
 p. 326.

From what has been advanced by SYDENHAM, relative to the removal or prevention of gouty concretions by exercise, might have been sufficient to answer our purpose ; but as it has been thought by some, that morbid matter generating any specific disease, acts like poisons, and is not capable of being assimilated by the powers of the constitution into the nature of our healthful fluids ; exercise, in dispersing the gouty matter through the habit, might be attended with dangerous consequences, inasmuch as it might be the cause of occasioning a deposition on the more noble parts of the machine—but as no such circumstance ever does occur from this cause, and exercise perfectly prevents the congestion, or in slight cases removes it ; it is more than probable, that the matter itself is such as is natural to the habit, and capable of circulating in our fluids like other of their healthful parts, with ease and security, and adapted to the particular purposes of nature's intent by the laws of the animal œconomy. —And this we considered it our duty to prove, from the

observations and experiments of medical characters of the first consequence.

From the circumstances above enumerated, it appears, that the causes which occasion those morbid affections with which too many unfortunate patients are oppressed, arise from inactivity ; it then can scarce be doubted, but that exercise early begun, and properly pursued, may prevent or cure these complaints before they are too obstinately fixed : for we must observe, that when the muscular parts have been continued in a state of contraction on one part for a long series of time, and too great extension on the other, the vessels, from obstructions remaining in them so long, will be consolidated with their fluids, forming instead of canals, solid substances—or the very texture of the parts may, by the accumulation of gouty concretions, be totally destroyed ; therefore it will be impossible to give flexibility or proper motion in these cases to the diseased parts.—Indeed, so well aware of this was SYDENHAM, and other physicians, that they advise exercise at an early period—and indeed insist upon it in all its various forms, with which they were acquainted, preferring that which gave the greatest power to the circulating fluids, adequate to the strength and convenience of their patients.—Because, as in exercise the muscles of the body are moved, the motion of the blood in the veins is accelerated, the heart contracts itself stronger and more frequently, as also the arteries—Respiration is equally increased, and thus all the powers assimilating chyle into sound humors, in a given time act more freely than in indolent men : all the secretions and

excretions are promoted, and by these means all things conspire to induce health.—For this reason, not only in the gout, but in all chronic diseases, physicians recommend exercise as salubrious—nor does motion of the body contribute only to sanguification, or forming of the blood—but also of chyle—since the pendulous viscera of the abdomen are thus agitated, and alternately pressed by the diaphragm and muscles of the abdomen, the secretion of the juices of the stomach—pancreas—intestines—and liver are increased. Whence men, subject to severe and constant labour, live upon any kind of food, and very readily digest it; whilst those who lead indolent lives, are oppressed with the lighter kinds of viands, and are constantly troubled with flatulence—Nor is it sufficient, that men should take exercise now and then, but have daily recourse to it, as necessity requires such perseverance.

But since the gout usually torments those advanced in life, they ought to contend against the sluggishness of old age, if they expect any alleviation of their misery; for unless they exert some resolution, both by old age and disease their limbs will grow stiff, and be rendered incapable of motion. And SYDENHAM has informed old gouty people, “ that nothing less
 “ is to be hoped for, *than that disease ever should be brought*
 “ *to any perfect termination without exercise*; for as the disease may by its violence conquer nature, they often die of
 “ languor and sickness, which the quantity of morbid matter
 “ resisting the power of concoction occasions; and from
 “ these unconcocted materials, which can by no means be
 “ assimilated, they are destroyed as by poison.” But still

this exercise, that it may be used every day, ought to be proportioned to the strength and age of the patients, lest they should be debilitated by fatigue.—Whence riding on horseback has in general been preferred, because it wearies those less who have been accustomed to it, and increases the action of the lungs upon the blood; but it is most beneficial if taken in a pure, clear air. But should riding on horseback be too severe, riding in a carriage may supply its place—though it will be less beneficial. Indeed, so essentially necessary has exercise always been considered, that there is no species which has not been advised; even the motion of particular parts has been recommended, that the rigidity of the joints, which is common in an inveterate gout, and very difficult to cure, might be avoided.

CÆLIUS AURELIANUS, an eminent physician of the city of Sicca in Numidia, supposed to be prior to GALEN, advises gouty patients to take wax into their hands, and by motion to soften it, or to hold the gauntlets, or leaden weights which wrestlers, or athletic men, called *halteres*, as well made of wax or wood, with lead placed in them, similar to our dumb bells,—and make use of them, obviously for the purpose of exercising the joints—riding also, at first in proportion to the strength, then walking on straw strewed upon the ground—to which he adds, exercise of the voice, with anointing the body—From whence it was obvious, that he was afraid of a rigidity or stiffness of the joints from absolute rest—and at the same time, to walking he added the exertion of the voice, that the action of the lungs might be increased:—it was also

understood, that these efforts should be begun whilst the fit was not yet completely finished, but some slight pain still remained; for beginning at first with the gentlest motion, walking was afterwards to be attempted, the ground covered with straw, and the feet uncovered with shoes, that the motion might be attended with less pain.

PAULUS of ÆGINA, a celebrated surgeon of that island, who lived in the seventh century, confirms this doctrine: he advises exercise and frictions, particularly of the joints, in the remissions, that is, when the pain is slight, the fit not altogether gone off; which is further ratified by the observations of SYDENHAM, who recommends gouty patients to use motion, though the joints are still in pain.

Friction itself, that gentlest species of exercise, if applied to the parts which during the gouty fit were usually afflicted with pain, has been of singular utility.

“ Certain I am,” says VAN SWIETEN, “ from a variety of
 “ experiments, that if gouty patients would constantly,
 “ morning and evening, use friction, particularly to the feet,
 “ which the gout most frequently attacks, they would find
 “ great relief—nor should the remedy be despised for its
 “ simplicity: I have ordered flannel impregnated with some
 “ aromatic fumes, at the same time exhibiting some soft
 “ ointment; still I will confess, from friction I have seen the
 “ same effect, if it had been administered for the space of
 “ fifteen minutes morning and evening—for the parts were

“ invigorated and strengthened so much, that if any morbid
 “ matter had begun to be collected and fixed, it was diffi-
 “ pated.”

ÆTIUS, a famous physician, born at AMIDA in Mesopotamia, who lived at the end of the fifth or beginning of the sixth century, strongly recommends frictions, as the most certain preventive of the gout; he orders it to be administered, “ Not, indeed, during the inflammatory or painful
 “ state, but in the remission;”—then enumerates these salutary effects, “ In all who use frictions in this manner, the
 “ natural heat is increased, and what is præternatural is
 “ dissolved—the recrementitious matter is dispersed, and the
 “ affected limbs become stronger, and are made less suscep-
 “ tible of the disease, particularly if they assiduously every
 “ day, night and morning, during life, make use of this
 “ remedy when the pains have remitted.”—“ But Ætius at
 “ the same time anointed the parts with oil intimately mixed
 “ with salt—though the most powerful effect ought to be
 “ attributed to friction.—I advised this preventive remedy to
 “ a gouty patient, who afterwards used to rub his feet very
 “ well, night and morning with his stockings, as he pulled
 “ them off and put them on, and was so familiarized to the
 “ operation in a little time, that he continued the frictions
 “ without any trouble, scarce thinking of it, so long as he
 “ lived.—But although he did not pay strict attention to the
 “ course of diet prescribed, sometimes indulging himself, still
 “ his gouty fits were slighter, and had longer intervals, and
 “ he preserved the flexibility and agility of his limbs, and

“ thus was enabled to use exercise.”—PHILAGRIUS had such an opinion of friction, that he with great confidence declared, “ That frictions alone were sufficient for those who were “ guilty of very great dereliction with respect to diet.”

From the opinions of the most experienced men, as well as from reasoning, it appears obvious, that the greatest benefit is to be derived from keeping the muscles in proper condition to perform their actions completely and regularly, thus constantly promoting a due circulation of the blood and humors, and maintaining a just equilibrium between the solids and fluids of the human machine.—From hence, then, we may fairly conclude, that whatever renders these muscular powers inactive, impedes the circulation, and destroys that equality which ought to be preserved through the whole, and every part of the habit, will not only injure the parts themselves, but be a means of debilitating the constitution in general, and laying the foundation for variety of other complaints.

Now if we examine the effect which must necessarily arise from the use of crutches, and wearing high-heeled shoes, with springs of different kinds, with intent to alleviate some distressing affections, we shall be convinced that they become causes of many painful diseases.

But, in order still to give a stronger idea of this matter, among the plates there are inserted three ; one to shew the the position of the machine on crutches—another, the situa-

tion of the thigh, leg, and foot with high-heeled shoes, springs, &c.—and another of the bones of the leg and foot, the better to explain what mischiefs are apt to arise in these parts, and how well calculated they are to be injured (see plates, No. 13, 14, 15.) by these contrivances. — These, therefore, we shall examine separately.

If we for a moment consider the variety of muscles of which the arm consists; that these are formed of fibres, which uniting into small bundles, called *lacertuli*, and these into larger called *lacerti*, and these again into muscles—the ultimate fibre being supplied with blood vessels, nerves, &c. and enveloped in a membranous substance, subject to adhesions, inflammation, rigidity, &c. from stimulus and obstructions,—that also, for want of a due circulation in the vessels, the inherent power of the muscle is debilitated, perhaps destroyed, as well as the nervous influence, inducing relaxation and torpor of the parts, we cannot hesitate to conclude, that considerable mischief may be occasioned by the pressure of the heads of the crutches on the muscles and vessels of the axilla; for by this pressure, which must be considerable from the weight of the whole body being applied to these parts, the blood is prevented from returning to the heart so quickly as it ought, not only from the *repagulum* placed in the veins of the axilla, and parts contiguous, but from the pressure hebetating the energy of the nerves, and rendering the vessels, in a great part dependent upon that power for vigorous motion, too sluggish in their motion.—From hence we find a preternatural congestion of fluids—pain brought on from vascular distension—a solicitation of fluids to

the parts more than natural—and frequently in gouty habits a deposition of acrimony on the metacarpal or small bones of the hand, the wrist and elbows, which, without the application to crutches, might have remained free from the attacks of the disease. Besides it too often occasions the gout to vary its situation at the end of regular fits, and subject the patient to an arthritic paroxysm in the hands.—Nor are these the greatest evils to be complained of. It is for the sake of present ease that patients have recourse to crutches, in order to crawl about without the pain of muscular motion, and hence lay the foundation for themselves becoming cripples the remainder of their lives; for to the limbs, as they will ever be kept in the easiest state, the same inconveniencies will occur, as has been represented pag. 59. and the patient at last fall a sacrifice to the gout itself, assuming the aspect of some other complaint, or so debilitating the active powers of the constitution, that some other malady puts an end to the scene of misery occasioned by inactivity, which has been fully enumerated in the former part of this work.

The same disadvantages are likely, and do often occur, from wearing high-heeled shoes, straps, and springs, at too early a period of some complaints, which might be rendered unnecessary by proper care in attempting to prevent contractions from being brought on, too often occasioned by inattention and ignorance.

In almost all these cases, debility has been the principal cause, as in scrophulous and ricketty habits; hence, when

pain has affected the legs, the same indulgence has been permitted as has been represented in gouty people, and of course the same consequences have occurred. To remedy which, instead of using that proper muscular exercise which has been before spoken of, recourse has been had to IRON JOINTS, STRAPS, and HIGH-HEELED SHOES; the FIRST of which can be of no use, for in the iron or artificial joints there is no power of motion, nor any assistance given to weak motion, if the natural joint is either void or possessed of too small degree of action.—The SECOND is detrimental by wasting the muscles, and depriving them of action from preternatural pressure producing the same effects, as specified in the application of crutches.—And the THIRD, occasions the tendons of the hams and heels to contract, by keeping the knees continually bent forwards—hence creating similar mischiefs to what have been above specified, pag. 59.

To all which we may add, that not only the muscles, tendons, and ligaments suffer, but also the joints, particularly those of the lower extremity: in order to elucidate which matter, a plate is given of the bones of one of the lower extremities, the peculiarities belonging to which may be applied to the arm and hand under similar circumstances.

From this plate it appears, that the foot consists of a variety of small bones, called tarsus, metatarsus, and bones of the toes named *phalanges*, which are thus concisely described. The tarsus is composed of seven bones, the first of which is called *astragalus*, supports the tibia, or large bone of the leg;

and is supported by the *os calcis*, or heel bone, which being projected backwards, makes a longer lever for the muscles that extend the ankle, to act with, and raise the body upon the toes—These two bones have a considerable motion between themselves, and the astragalus also, with the *os naviculare*; and all the rest an obscure motion one with the other—and with the bones of the metatarsus, the greatest part of these motions being towards the great toe, where is the greatest stress of action; *these bones thus giving way, are less liable to be broken, and as a spring under the leg makes the motions of the body in walking more easy and graceful, and the bones which are supported by them, less liable to be fractured in violent actions.*—To these join five others, called the metatarsal bones, that which supports the great toe is much the largest, there being the greatest stress in walking; under the end of this lie the two sesamoid bones, (called so from their resemblance to the sesamum seed) which are of the same use as the patella, commonly called the cap of the knee—The great toe has two bones, the lesser three each, and the two last of the least toes frequently grow together.

The bones of the tarsus are united to each other by very strong ligaments, and their articulation with the foot is secured by a capsular and two lateral ligaments; each of the latter is covered by an annular ligament of considerable breadth and thickness, which serves to bring down the tendon of the foot, and at the same time to strengthen the articulation.

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With regard to the toes, although they are more confined in their motion than the fingers, yet they appear to be perfectly fitted for the purposes for which they are destined.

In walking the toes bring the center of gravity perpendicular to the advanced foot; and as the soles of the feet are naturally concave, we can at pleasure increase that concavity, and form a kind of vault, which adjusts itself to the different inequalities that occur to us in walking, and which, without this mode of arrangement, would incommode us exceedingly, especially when bare-footed.

From the number of these bones, the nature of their junction, their situation and uses, obstructions are more likely to be formed in the ligamentous substances by which they are united, than other parts of the machine, particularly by the feet being kept too long inactive, and more especially if the blood is impeded in its motion towards the heart by any obstruction placed in a superior situation.—Hence will be brought upon these parts severe inflammations, consequent obstructions, adhesions, stiffness and rigidity at their separate junctures, inability to motion, and that halting, hobbling, infirm mode of walking gouty valetudinarians so often exhibit, if they escape the more severe degrees of decrepitude arising from what are called chalk-stones—nay, indeed, sometimes it happens that the tendons and ligaments, and even the bones themselves, have been destroyed by the constant deposition and detention of arthritic and other acrimonious matter in these parts, which probably might have

been prevented by proper exercise, that is, by exercise adapted to the parts; which peculiarity must be attended to, it is evident from the situation and nature of the parts themselves, as no *general* plan can sufficiently affect them to produce the intended salutary purposes.

It is no small satisfaction to me, that I have been enabled to lay before my readers, not only the utility of general, but also the necessity of *partial exercise*, from the authority of the most respectable characters in medicine, both ancient and modern. But they seem not to have carried the latter far enough; for though we will allow great benefit may be derived in many cases by the strict observance of the rules which may be deduced from what has already been advanced in mild and recent cases, still will they all be insufficient in cases more inveterate, though curable by proper applications.—We find many arthritic subjects who, either from extreme debility, pain, or some other cause, cannot of themselves give power and force enough to the muscles, either to counteract the great contractility of some, to give proper elasticity to others—or promote a due circulation sufficient to alleviate or cure the local affections.—For many can only submit to frictions, which are applied too *superficially* to produce proper action on the more interior parts: for we find, that neither the muscular fibres, tendons, nerves, blood vessels, nor lymphatics, which are deeper seated, can sufficiently experience the effects which ought to be occasioned by motion;—a great number of convalescents, who have used frictions assiduously, can be brought in proof of this assertion, and such as have

by more powerful motion applied to the limbs received every desired benefit.—Some contrivance, then, has been long wanting, whereby all the muscles, left in a morbid state of debility, might be thrown into action, and that action continued, or their too powerful contractility counteracted, and that with as much ease as the nature of the case would admit, or the necessity demand.—It has been my study for a number of years to contrive such an apparatus; how far I have succeeded, will be most satisfactorily proved by the following cases; a careful comparison of which with the principles that have been laid down in the foregoing sheets, will shew incontestably, I flatter myself, that the plan is founded on reason, and not on the vain boastful pretences of quackery and imposition.

C A S E I.

*In a Letter to Mr. PUGH, from JOHN ANDERSON, M. D. F. A. S. C. M. S.
 &c. &c. communicated to the MEDICAL SOCIETY, LONDON.*

S I R,

HAVING met with a remarkable instance of the efficacy of your machines very lately, in a most deplorable case, I was induced to communicate it to the London Medical Society, of which I have the honour to be a member; the words verbatim are as follow, which you are at liberty to shew to such of the faculty, and others, as you shall think proper, as I flatter myself every liberal, observing, and candid mind will be disposed to listen to impartial facts that so nearly concern the general good of society.

I am, SIR,

Your's respectfully,

JOHN ANDERSON.

London, 23 April 1791.

*Copy of Dr. ANDERSON's Letter read to the LONDON MEDICAL SOCIETY,
March 1791.*

MR. PRESIDENT,

I BEG leave to notice to the Society a recent fact of the efficacious power of chamber muscular action in suppling rigid joints.

THOMAS NEWTE, Esq. of Gower-street, Bedford-square, a native of Devonshire, where the *gout* is hereditary almost in every family, had, from many heavy irregular attacks of the gout, the joints of his arms and legs grown so stiff as to be almost inflexible.

After medical treatment had proved ineffectual, nay detrimental, he applied to a *Mr. Pugh*, who exercised his joints daily for some time, and he regained the full use of his extremities. He supplied him, at the same time, with machines that he exercised himself with at home in his own chamber; by which not only his rigid joints were slackened, and his cumbersome corpulency reduced, but strength and energy were given to his whole system, so far as to enable him to walk, ride, and do other manly exercise better than he had been able to do for years.

Though exercise (partial or universal) alone is not equal to cure the gout, yet, in this instance, joined with temperance and regularity, by giving strength and activity to the system, assisted greatly to ward off irregular, wild, and debilitating fits for eighteen months without interruption, and allowed Nature time to collect her strength, to throw off noxious accumulations by a kind and regular fit, which he happened to have the latter end of last year at Margate.

He called me in early to conduct him through it, as he was afraid it might prove as lingering and debilitating as his former fits used to be, from the drastic method he used to be treated, but which was not the case now; it was regular, I had only occasion to order him a dose or two of rhubarb and magnesia alba, consisting of a few grains of each, and a few leeches

to his knee and wrist, which were swelled and inflamed, but which the leeches effectually relieved at once, that is, the inflammation and pain abated, and the swellings subsided; the tension being thus taken off the skin, and, by keeping in bed, a pleasant diaphoresis came on, which being supported by tepid diluent drinks for two days, they terminated kindly, and he mounted his horse two days after, and rode ten miles with ease; and by continuing his horse and chamber exercise, his life is rendered bearable, nay, comfortable to him; for his joints are not only suppled, but his general health is mended; and Nature not being drove, but led, his fits are brought to be more regular, the intervals more distinct, and the paroxysm less tremendous.

Were there no more instances than this of the great benefit received by the use of these machines (but which I am told there are many) the ingenious contriver of them merits public attention, and countenance of the Faculty more in particular; for who deserves more encouragement and support, than he who shall by his industry and ingenuity contrive means to save life, and render it comfortable after medical art has proved ineffectual?

In no disease whatever is the beneficial power of exercise, temperance, and regularity more fully marked than in the gout, both hereditary and acquired.

Indolence and gross high feeding are great promoters and increasers of the gout.

Exercise, plain nutritive diet, regularity and moderation, are their great antagonist; they help and strengthen the nerves; and the benefit our corporeal frame receives by the amicable conflict, is only equalled by the acquirement derived to the mental powers; the understanding and memory grow stronger by exercising them; they suffer by disuse and neglect. When the body is in health, the spirits dance, and the mind is in tune; the corporeal frame is subservient to internal impression, and the incorporeal or mental to external; it is for art to keep them in unison—go hand in hand. If noxious particles are prevented from gendering by exercise, and mild balsamic ones supplied in their place, gout will be suppressed, even that

which is hereditary kept within circumscribed bounds ; and the habit being clear of incendiary particles by critical discharges, the paroxysm will be kind and regular.

It is as necessary to have a perfect crisis of gout as of fever, or the thief will harrafs and be perpetually haunting the habit to its destruction.

(Signed) JOHN ANDERSON.

C A S E II.

From JAMES WATSON, Esq. M. P. Serjeant at Law.

S I R,

AS you are about to publish a treatise on the principles and utility of the method employed by you for muscular exercise, I think it my duty, in compliance with your request, to authorize you to make any use you please of such testimony as I can give in confirmation of its efficacy to prevent chronic diseases, and relieve persons afflicted with them ; to restore the tone of relaxed muscles, reduce those which are contracted, and assist the joints when impaired by inaction ; to promote recovery from nervous injuries, even when attended with alarming symptoms of the paralytic kind ; and to ward off and remove the various complaints and diseases with which the health of sedentary persons is most commonly liable to be attacked.

I have personally derived great benefit from it in all the particulars above enumerated, and several other gentlemen, within my knowledge, have obtained relief from your apparatus, and assistance in several cases of a similar description. I will succinctly mention what immediately relates to the benefit I have myself received. The complaint which occasioned my first application to you was of a singular nature, and must, I think, as far as relates to its cure, be ranked under the head of paralytic affections : for, after having struggled eighteen or twenty hours with an extraordinary kind and degree of pain, proceeding from the right side of the small of my back, I was seized by violent spasms, shooting, as it were, from a point in the

very center of that pain, and accompanied with a tingling, or sort of pricking sensation, like what is felt in the sole of the foot, when, according to the common phrase, it is said to be asleep. This sensation spread down the loins, round the lower part of the abdomen, and over the whole surface of the thighs, legs, and feet: these parts were, in a few seconds, reduced to a state of total insensibility, and quite deprived of all power of motion; but the injury did not extend upwards.

This misfortune happened to me in the forenoon of the 11th of October 1788, and it was not till the 30th of January following that I discovered the cause of it to have been a very fine needle lodged in my body at the spot from whence I traced all my sufferings, to which the source of them was fixed, till within a few days of my making the discovery, and which, during the whole time, seemed so small, that I could cover it with the end of my little finger, though the mischief spread so wide.

A discussion of the various grounds of conjecture, as to the time and manner of this needle's having entered the frame; a minute enumeration of the various complicated symptoms of the disorder produced by it; and a narrative of the different effects of the respective medicines and topical applications administered; accompanied with remarks upon some of the most particular attendant circumstances; may, perhaps, hereafter meet the public eye: but it is evident, that whilst the instrument of my misery remained in its seat, a perfect cure was hardly attainable.

To my valuable friend, Dr. Reynolds, I owe much gratitude for a great degree of palliation: he devoted no small share of his time and consideration to search for the cause of an attack so uncommon; and, from a careful observation of the symptoms, he was enabled to supply, in the most efficacious degree, every assistance and alleviation that medical science and skill could devise.

I also derived considerable benefit from muscular exercise by your assistance and the use of your machinery, whilst I yet remained in a very helpless condition. When I first applied to you, I had recovered scarcely any sense of feeling beyond that of numbness and of dead cold, and but a very slight

power of motion in my lower extremities. I could, indeed, barely rest upon them with my body inclined forward; but such was their remaining weakness, that I could not stand upon them without support, nor could I stand upright at all. These limbs were, however, speedily restored to some animating degree of warmth in consequence of the circulation being quickened in them by exercise; as the blood came to be thereby pushed into the capillary vessels and excited to the surface the white and perished skin threw itself off from the bottoms and sides of the feet, and the whole surface of the skin gradually presented itself to the touch in a more healthy state, and began to assume its natural appearance; the joints, particularly of the knees, daily gained strength, and the muscles progressively, though by slow degrees, and as the fruit of regular and long perseverance, ultimately acquired again the tone which they had so entirely and suddenly lost.

From the very first I perceived, that by your aid and skill in adapting the mode and proportion of exercise to my enfeebled state, I could take as much as was requisite with very little exertion of my own, and consequently without fatigue. The most immediate advantage which I sensibly perceived to result from the use of it, was the warmth above-mentioned, and next to that I found the operation of the medicines prescribed for me to become more efficacious; the consequence was, that my nervous irritation gradually subsided; the various distressing symptoms occasioned by my pain were diminished, and my general health was promoted long before the cause of my misery was removed: for all this while the seat of the disease remained permanently fixed as ever. You will recollect what daily pains you took, for many weeks successively, to vary the application of different machines to the muscles of my back and loins, and in how many changeable positions you placed me to employ them most advantageously, without my gaining any apparent ground, either by those means, or from your manual assistance, towards the eradication of the evil itself, although its consequences were so much softened; and, from an apprehension that its root might possibly be in the spine, I was at one time nearly persuaded to attempt to reach it by submitting to the application of caustic, under the surgical care of the late Mr. Pott. In all probability the needle would have been discharged at the wound, but I providentially escaped

the additional suffering that must have been occasioned by so severe a remedy.

I will shortly relate their circumstances and manner of my deliverance.

On the 26th of January 1789, above a quarter of a year after the first attack, whilst I was in the use of your machinery and made very warm by the exercise, I was suddenly struck with an extremely violent renewal or rather increase of anguish at the very seat of the habitual pain. You may recollect that a degree of spasm, and of temporary aggravation of the pain immediately in that part, generally came on during the time that particular muscles were in a state of extension; but this was so much more instantaneous and severe than usual, that for a few minutes I apprehended it to be a relapse: happily it did not so terminate. The spasms did not spread, nor continue after the parts were relaxed; the nervous insensibility and attendant incapacity, which I know not how to describe but by calling it a paralytic affection, did not return upon me; on the contrary, all my sensations soon became more tolerable, though the violence of the pain did not so immediately abate in the spot where the needle had lain, as the effects did in other parts; but I could move with rather less inconvenience than before in the course of that evening, and I was distinctly sensible next morning of a new sort of feel, very different from that which I had been accustomed at the stationary point, and rather higher up my back. This I perceived to shift, and I traced its course nearly in a regular progress for that and the two succeeding days. About this change, ignorant as we then were of its cause, a variety of conjectures were entertained by my medical friends. It did not occur to us then to examine the back, otherwise the probability is that the needle would have been felt lying under the skin, as I could have pointed to its place at any instant between the evening of the 26th and morning of the 30th of January, when I made the discovery; for at that time it was so close under the skin, just at the lower part of the deltoid muscle of the right shoulder, as to be readily extracted; putting my hand upon the part affected I felt something extraneous; upon my gently pressing round it with my fingers, the point presented itself; the smart was trifling, and as I drew the needle out, the feel was as if I had been drawing a hair through the skin.

The appearance immediately afterwards was like an exceeding small pimple with a puncture in the middle ; but there was no observable discharge of moisture from it. The needle itself was cas'd, or rather bronzed over, and discoloured almost to blackness ; but with a smooth polish and not rusted. This discolouration soon began to wear off from the point and eye, by handling ; but I have taken care to preserve the middle part untouched. It should seem that when I was struck while at exercise, in the manner above described, on the fourth day before the discharge of the needle, it started from the bed where it had so long lain buried, and got into the cellular membrane above the external muscles ; for it could not have passed through the substance of the flesh so expeditiously, nor betwixt the muscles without much greater pain. The sensation of uneasiness which accompanied its journey was by no means acute, except during the night of the 29th, when the whole region of the right shoulder was in excruciating torture ; perhaps from the irritation of some small nerve in that part of the passage.

It will not seem extraordinary to any person who has observed how speedily an ear of corn, or even a pointed slip of stiff paper, inserted at the wristband of his shirt sleeve will travel over the whole surface of his body, that this needle should have made so quick a progress when put in motion between the surface of the external muscles and the skin, having no resistance to encounter, but from the fine laminæ of the cellular membrane, and those so lubricated with an oily matter as rather to help forward than retard such a slender and polished body as this needle was ; upon which therefore the effect of the muscular action must have been similar to that produced by it upon larger and coarser substances inserted between the skin and the cloths. I was at that time in the habit of full exercise upon your plan ; and think it providentially fortunate for me, that the course by which this needle was expelled lay in a direction so much less hostile than that by which it had entered.

The progress of my recovery was from this time rapid to a certain point ; but I never got rid of all the effects of the injury till the autumn of the present year, if in truth some few of them are not still remaining ; and whether any of the dorsal or lumbal nerves had received an actual wound, or whatever was the mischief done, I was rendered liable to an extraordinary

and very uncomfortable sort of irritation, which I am unable properly to describe, for a great length of time. Almost every change of weather, and often the drinking of a single cup of tea, would bring on catchings and twinges proceeding from the part where the principal injury had happened to the right hip, and down the whole lower extremity on that side. In like manner attacks both of gout and rheumatism, which I inherit, with which I have since been troubled, seem to have been made on that limb as the weak part. It is, however, singular, that during my first confinement, before I applied to you, the left leg was the most wasted, and, I think, the coldest of the two ; but soonest recovered strength and its natural appearance.

Although the paralytic symptoms in my case were produced by a cause so uncommon, there are circumstances in the preceding narrative which make me think it reasonable to conjecture, that when similar effects are produced by their more ordinary causes, perseverance in a course of exercise, especially under your care, will be found very beneficial in itself, and will contribute much in aid and furtherance of medicine. I know that prior to the cause of my complaint being removed, I received more sensible advantage both from electricity and the medicines prescribed, particularly those of the nervous class, when immediately preceded or followed by the exercise than at other times.

I likewise have reason to think your mode of treatment peculiarly well calculated to give additional efficacy to the use of the Bath waters. When I have taken the exercise there just before, but more especially directly after bathing or being pumped upon, I have found it most peculiarly beneficial ; and even in the bath I have often received advantage from stretching the muscles and working the joints, as much as I could of myself without the aid of any other machinery than the rails, ring-handles, and steps.

As applied to cases of gout, I have observed in myself and others that the exercise is undoubtedly useful after the fit to restore the strength and tone of parts weakened by the inflammation, or which have become rigid by inaction and the accumulation of peccant humours ; and one may venture to conclude, without any pretension to medical knowledge, that by so doing it

will operate as a preventive to chalky concretions at the joints. I likewise believe that the disease itself may, by the regular and daily use of this remedy, be overcome in most constitutions; in my own at least, I have experienced it to be calculated to prevent the gouty matter from generating or determining itself to the joints so fast as not to be easily thrown off. I have several times, upon becoming oppressed with those symptoms which every person of a gouty habit feels at the approach of a fit, returned to the exercise when I had intermitted it, and increased the measure when I had been using it, and by so doing for a good length of time together, have chased the enemy away. There may be, and I dare say are, some cases too obstinate for this; where the seeds of the disorder are too thickly sown for the constitution to be cleared from them by these or any means, or at least without much greater difficulty, especially when the whole frame is much enervated. I have a friend who, after the most regular perseverance for years together in the exercise, has not conquered the malady; his fits will return in spite of all; but he is restored to activity, after having the muscles of his loins and the tendons of his lower extremities so contracted as to endanger his being a cripple for life; and all his sufferings are so much abated, that I do not despair of seeing him at last enjoy the fruit of his steady perseverance in a perfect recovery.

Whatever portions of the disease are got rid of by this course, they are completely thrown out of the habit; for hereby the humours peculiar to the disease are, like the circulation, pushed from the center of the body to the surface, and being once excited to the skin are driven through its pores; hence none of the injurious consequences produced by medicines taken to check the progress of this disease can follow. At least I speak for myself, that so far from having ever suffered the slightest inconvenience, I have always gained an acquisition of health by this method of relief.

I consider a fit of the gout to be a dreadful evil, though not an evil of equal magnitude with that of having the constitution overloaded by gouty particles and yet too weak to throw them off. But I believe no person who has been subject to the gout, even in its mildest and most regular form, can

doubt of its being so far prejudicial to his health, that he would have been better not to have had occasion for relief by this effort of nature, and that it is never made without giving some shock to the constitution. I believe that most of those who suffer much by this, which is vainly boasted of as a cure for other diseases, at last die martyrs to it: and yet it is frequently accompanied with so strong a disposition to inertion, that many of its sufferers would rather alternately lie down under its torments, and during their intervals of ease wait its periodical returns in indolent or luxurious indulgences, than put themselves to the mortification and trouble of an habitual daily course of temperance and exercise. But a sudden effort or a temporary application of this remedy will not counteract a malady which, when it does not come by inheritance, is generally the purchase of intemperance. It must be persevered in to be successful.

You need not, in your dissertation on this subject, prohibit the use of your exercise during the inflammatory fit, which it would certainly aggravate; for no person can then employ it. And in two violent attacks of rheumatism, both supposed to be accompanied with atonic gout, from the last of which I am now recovering, I found the disease much aggravated at its commencement, and in the progress of the inflammation, by resorting to the use of your machinery. Its rage was increased by the slightest degree of motion during its advancement; but being once at its height, notwithstanding the parts affected had suffered considerable injury, I found, that by first beginning very gently, and progressively increasing the artificial exercise, I soon acquired the capacity of using my joints and limbs as before.

Where persons have health, strength, and leisure for taking as much exercise by riding, walking, or in their occupations, as their constitutions require, there is no need of applying to this admirable substitute of yours. But the generality of the studious and of those of sedentary employments must, I am sure, reap unspeakable benefit from the daily use of it. Some require more muscular exertion than others to preserve their health: I require a great deal; and therefore when deprived of the opportunity of taking it in any other way, I have uniformly derived the most salutary benefits from pursuing your directions; and having a chest of your portable machines,

which I keep in my dressing-room, I find that I use them most advantageously night and morning with my cloaths all loose ; I can by this mode without labour, at all times, acquire as strong and universal a glow in about a quarter of an hour, as by three hours hard riding or by walking for a longer time ; a circumstance of no slight consideration to the studious, the sedentary artist, and a variety of persons occupied in mechanical employments.

I am, with real gratitude, and every good wish for your success—

SIR,

Your very humble servant,

Powis Place,
20th November 1792.

JAMES WATSON.

C A S E I I I .

From Col. ORCHARD, M. P.

SIR,

I CANNOT defer thanking you for the benefit I have received from your excellent method of treating gouty persons who have been deprived of the use of their limbs.

I do with gratitude acknowledge that your muscular exercise has restored health, and the action of the muscles to myself and to many of my acquaintance.

If any persons are desirous of a more particular account, I shall be happy to be of any service to them and to you. I am, wishing you every success,

Your obedient humble servant,

Chesterfield-street,
April 29, 1790.

PAUL ORCHARD.

C A S E IV.

From Mr. SHEPPERSON, No. 137, Oxford Road.

S I R,

THE relief I derived, in a paralytic case, from your mode of treatment, by the means of your apparatus, induces me thus to acknowledge it, with a view that it may prove equally salutary to others in similar complaints.

The numbness which pervaded over my left side and extremities is now removed, and warmth, with general circulation, is restored with the strength of my extremities.

I am wishing you success, because your system is rational, safe, and efficacious, and willing to satisfy, personally, any inquiries, should my written testimonial be doubted.

I am, SIR,

Your obedient humble servant,

May 12, 1791.

JOHN SHEPPERSON.

C A S E V.

Dayham, Suffolk, May 23, 1793.

S I R,

I HESITATE not one moment in paying just tribute to your very rational method of treating the limbs that have been debilitated, and the joints stiffened and contracted, by frequent attacks of the gout, and am myself a strong instance of the utility of your muscular motion, by which I am enabled to walk much further and with greater satisfaction than I have done for several years. My ankle joints, which were exceedingly stiff, are now become pliable, and the swellings, which almost constantly attended them, much subsided.

I am happy (for the benefit of those laboring under the same complaint) to have an opportunity thus publicly to declare, that I think your system founded on sound reason, and am very well satisfied with the progress I have made since I have practised your muscular action by means of your well-adapted apparatus.

I am, SIR,

Your most obedient humble servant,

Darham Hall, near Yoxford, Suffolk,

April 12, 1793.

C. PURVIS.

C A S E VI.

From A. YUELL, Esq. to Mr. PUGH.

S I R,

ABOUT five years ago, when I applied to you, I was entirely disabled from walking, even the length of a street, owing to a severe and uncommon pain affecting my limb from the right hip to the outward ankle.

After my friends had rendered every attention in their power, they advised me to give up farther trials, and remain inactive; yet the relief a gentleman of my acquaintance had derived from the use of your apparatus, induced me also to try its efficacy, which indeed had the desired effect by enabling me, in the course of a few weeks, to walk eight miles at a time and take my usual recreations.

I was at that time also troubled with gouty symptoms, of which I am entirely relieved, as will appear from a personal confirmation.

I am, SIR,

Your humble servant,

No. 25, New North Street,

Red Lion Square.

June 4, 1793.

A. YUELL.

C A S E VII.

From Mr. DAY to Mr. PUGH.

S I R,

HAVING had, from an unknown cause, lost the use of my left lower extremity upwards of two years, and in attempting to ride on horseback was obliged, from the severe pain, to be helped off, and never attempted the horse since the year 1790.

A gentleman of the faculty advised me to use embrocation, which, in some degree, afforded relief; notwithstanding, the seat of the complaint being so deep in the back muscles of the thigh, (as you expressed it) that walking the length of a street produced great pain.

I was persuaded, by the recommendation of a gentleman of distinction, who had derived benefit from your assistance, to undergo your mode of treatment, which certainly has enabled me to ride on horseback with pleasure about ten miles at a time; and, for the sake of such persons who may labour under similar complaints, I am ready to satisfy them personally of the truth of this assertion.

I am, respectfully,

Your humble servant,

No. 95, Gracechurch Street.

T. DAY.

C A S E VIII.

From J. DAVIES, Esq. to Mr. PUGH.

S I R,

THE essential service you have afforded me, by the means of your apparatus, leads me to give an impartial account of it.

About five years ago, as I was walking on Westminster Bridge, the stones being slippery, I unfortunately fell on my left hip, the effect of which disabled me from walking ever since.

I immediately applied to the late Mr. Wright, Surgeon, who, after many trials, blistered my hip for a considerable time, and, strange as it may appear, said, that if ever I should recover the use of my limb, it would be by the means of putting the limb in motion; but not having described what motion or method, my limb, from the hip down, became gradually more contracted and wasted, that, in short, I could only go few steps about the room, bearing on one leg, with the assistance of two sticks, at the time I was recommended to apply to you; though I had been at Bath during two seasons, and at the hot salt baths in Margate; neither of which rendered me the least relief.

The hip at length became so painful and tender, and the limb numbed and wasted, that I could not bear the least weight upon it; added to this, the vicissitudes of a West India climate during thirty-two years (having left Devon my native country at an early period) had greatly debilitated me, prior to the fall, and your mode of treatment has not only restored warmth and comfort to my limb, but also aided greatly to the recovery of my general health and spirits, by promoting, without fatigue, a full circulation, and thereby lessening the quantity of bile, which was also become troublesome.

Since, at my time of life your system proves to be efficacious, I would earnestly recommend others in similar complaints to lose no time in applying for your assistance.

I am now enabled to walk near a mile at a time without assistance, and my knee, which was so much contracted, is as flexible and straight as the other; for which uncommon relief I think you well deserving public notice, and the grateful and just acknowledgement of,

Pentonville, Islington,
No. 2, York Place.

SIR, your sincere humble servant,

JOHN DAVIES.

C A S E IX.

From J. P. HARRIS, Esq. to Mr. PUGH.

S I R,

HAVING been informed, that you intend shortly to make public your System, or mode of treating those afflicted with that painful disorder the Gout, I take this the first opportunity of declaring my approbation of the same, and to assure you, that though at the time I was under your care, (which is now two years since) I was unable to take much exercise, yet, from the little I then took, I flatter myself I still feel the good effects of it, as my health is much amended, and the disorder is less violent, nor are the attacks so frequent as they were wont to be; you are at liberty to make what use you please of these my sentiments, and I trust you will have the same permission from gentlemen of the first respectability, who, (from my own knowledge) have received much benefit from your mode of treatment, I beg you will add my name to those of your other subscribers. Wishing you success,

I am, S I R,

Your obedient servant,

Baghurst, 18th July 1793,
Basingstoke, Hants.

JN^o POTTER HARRIS.

C A S E X.

A LADY who has permitted the author to refer to her, had, from a supposed nervous affection, entirely lost the power of her fore arm and hand, which at length became so relaxed and wasted, that her friends doubted of her ever recovering the use of them.

In this unhappy situation, she was advised to try the efficacy of the apparatus, with which accordingly she daily exercised the arm during six weeks,

and in the course of that time it recovered its fleshy appearance, size, and strength, notwithstanding every other application had proved useless.

Several other ladies have also derived benefit in decayed and contracted extremities; and children with protuberant and weak limbs have been likewise relieved. The parties and parents have authorised a reference to be made to themselves in some of these cases.

C A S E XI.

Copy of a Letter to Mr. PUGH, from a distinguished personage recommended as a Patient by Mr. Woodmason of Leadenhall-street, to whom the Reader is referred for a more particular account.

S I R,

AS expected, I was detained in the city too late to return, and I was obliged to leave London the next day, without having it in my power to call upon you to thank you for your advice, of which I already feel the good effects,* and for your instructions, which you may rely upon being implicitly attended to.

I shall not fail to mention, whenever I think it may contribute to your advantage, the opinion I entertain of the use of your apparatus, and also of that which may be derived from your mode of treatment.

I hope I shall be enabled on my return to town to give you, in person, an additional proof of the efficacy of the principles of the mode of muscular motion which you have established, and remain till then,

July, 1793.

Your obedient humble servant.

* This Case was a Distention of the *Tendo Achillis*, with swelling and tenderness in the soles of the feet.

C A S E XII.

From R. OLIVER, Esq. to Mr. PUGH.

S I R,

I WAS absent from Layton when your letter arrived, otherwise should have answered it sooner.—It is impossible that I should have the least objection in your making mention of my name in recommendation of your system of Muscular Action, as I am confident, from experience, that in many cases it will prove most beneficial.

Layton Stone, Essex,
26 July, 1793.

I am your obedient,

RICHARD OLIVER.

C A S E XIII.

From R. CAPPER, Esq. to Mr. PUGH.

S I R,

AS I know you intend, for the benefit of society in general, to publish your method of treatment of persons who have the misfortune to be affected in the use of their limbs, either by gout or rheumatic disorders, I think I ought, in justice to you, to declare, which I can with great truth, how much benefit I have received from your attendance and instructions to me under this disorder.

I was, in December 1791, attacked by a paralytic disorder, by which I lost the use of my right side; when I recovered a little, I was advised to take a journey by way of exercise: I set out accordingly, and travelled by the sea coast. I did not return till November 1792, and at that time, though I had received great benefit in my health, found very little alteration

in my limbs till I applied to you, when, I can with great pleasure say, that by your attendance and instructions, I can now, with very little assistance,

Walk about the room, and use my arm perfectly well as to feeding myself, and even writing in some degree, though before my hand and arm were totally useless; and I have no doubt, by still pursuing your method, I shall recover in time entirely from the effects of the paralytic disorder.— I am, with many thanks and good wishes for your success in the plan you have established.

Your obliged and obedient humble servant,

Lincoln's Inn,
Sept. 25, 1793.

RICH^d. CAPPER.

P. S. You are at liberty to publish this, if you think proper; and I shall be ready at all times to give any information, at your request, to any body labouring under the same disorder.

C A S E XIII.

From E. BARNETT, Esq. to Mr. PUGH.

S I R,

THE very uncommon relief you have already afforded a son of mine five years of age, induces me with pleasure thus publicly to declare it, as being of essential importance to society, particularly to those parents whose children may, from contraction or relaxation, have lost the use of their limbs.

A succinct account of this very uncommon case is as follows: The outward bones of the child's right foot had been so much out ever since he was a year old, that the articulation of the ankle and foot seemed to have no connection with each other; for on lifting up the leg the foot dropped down, and turned inwards, as if from debility it had been withered—

his left hip also was very protuberant, and from the hip down to the toe much wasted.

The right foot above described is now perfectly straight, the ankle joint re-placed, and the foot altogether strengthened; upon the whole, the child is materially better since the three months you have had him under your care; and I have reason to hope, from your tender and judicious treatment, to see him, ere long, enjoy general strength.

I am, SIR,

Your obedient servant,

No. 10, Henrietta Street, Covent Garden,
Nov. 1st, 1793.

E. BARNETT

P. S. Prior to my applying to you I had been recommended to cramp his legs with *irons* and *straps*, which, from this compressure, proved not only useless, but highly *dangerous*, I was glad to find you made no use of such confined remedies.

C A S E XIV.

From Mr. GRIFFITHS, Wine Merchant, to Mr. PUGH.

S I R,

WITH gratitude I send you an account of the relief I derived (in a very uncommon case) by your mode of treating those persons who have lost the power of their limbs; I cannot hesitate in asserting it, as it may be the means of informing other persons who may labour under similar pain.

About a year ago I felt a very unpleasant sensation from my great toe up to the front of my thigh, which, I supposed, had arisen from cold; the pain gradually increased, and in the course of six months I was actually

unable to walk even a quarter of a mile, for the more I attempted to move, the more I suffered. I had tried opodeldoc, and several other things, and still suffered a perpetual gnawing pain, which did not abate till I fortunately applied to you.

I am now enabled to walk several miles, and my limb is perfectly free from the distressing pain which I laboured under.

I am, SIR, with due respect,

Your very humble servant,

October 9th, 1793,
No. 4, Fore Street, Canterbury Palace.

JAMES GRIFFITHS.

P. S. For the farther authenticity of this Case, Mr. BLAND, of the Bath Hotel, Piccadilly, has also given leave to be referred to.

C A S E XV.

From Mr. BROOKS, late of Great Queen Street, Lincoln's Inn Fields, Paper Stainer, to Mr. PUGH.

S I R,

ABOUT six years ago, then advanced to the age of sixty-nine, I laboured under a fit of rheumatism, which produced severe pain and stubborn contraction in my right knee, and at length obliged me to be carried by two of my servants from one room into another at the time I applied to you.

B b

By the use of your apparatus and safe mode of treatment the severity of the pain was much alleviated in a few days; and in the course of two months regular application, only one hour a day, my knee became so flexible and strong, that I was enabled to walk from Hammersmith to my house in London, and have ever since enjoyed the use of my limbs, and even at this time walk several miles daily.

I am, SIR, respectfully,

Your obliged and obedient servant,

Nov. 18, 1793,
Morden College, Blackheath.

JOHN BROOKS.

C A S E XVI.

A GENTLEMAN who had laboured for several months under a lumbago, has permitted the author to refer to him persons of respectability who wish to be informed of the essential benefit he derived from the use of the apparatus, notwithstanding he had been obliged to apply a plaister across the loins for a considerable time, but to no purpose, as it prevented the necessary action of the lumbar muscles.

Prior to his commencing the exercise it was thought prudent to take away the plaister, in order to restore the flexibility and wonted action of those muscles affected.

The gentleman's own personal authority may perhaps be more satisfactory; therefore any doubtful person desirous of this, will, on applying

to the author, have a card directed to the Gentleman in town, who, since the year 1790, has remained without a relapse, merely by regularly attending to the easy rules pointed out to him.

C A S E XVII.

From Lieut. Col. DAWSON, Chelsea College, to Mr. PUGH.

S I R,

HAVING derived more benefit from your mode of treatment than from any other, I with pleasure permit you to insert an account of it, as it may be useful to those persons, who like myself advanced in years, labour under the gout.

I candidly own, when I applied for your assistance I could not stand alone with safety, being obliged to have my servant on one side and a stick in the other hand, and was also carried from room to room, and into a carriage.

It is with pleasure I announce that I am enabled to walk about the house and into the carriage, and go up stairs without any other assistance save a stick.

The safety and conveniency of your plan, is a sufficient inducement to all debilitated and aged persons to try its efficacy.

I am, SIR,

Your obedient servant,

Dec. 28, 1793.

THOMAS DAWSON.

C A S E XVIII.

From Mrs. PALMER, Pall Mall, to Mr. PUGH.

S I R,

IT is with much pleasure I can say, that I think my daughter has derived considerable benefit from your judicious mode of treatment.—The contraction is by no means so great as when I first applied to you, and she has also acquired a great addition of strength. I am so persuaded of the efficacy of your system, that I believe had I had the good fortune to meet with you at an earlier period of her complaint, and before time had so fixed the contraction as to preclude the expectation of its being overcome, she might have been entirely recovered.

I am,

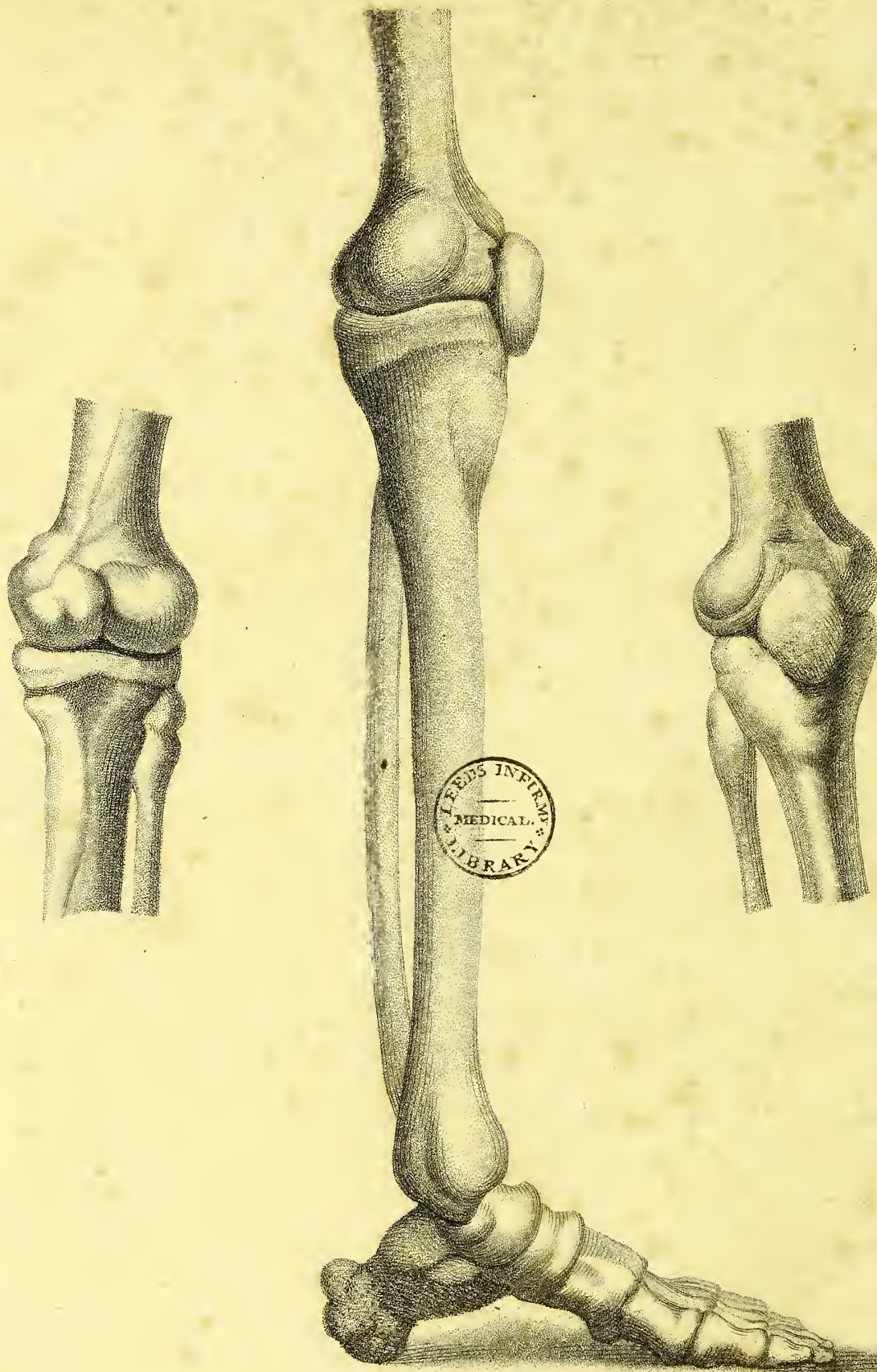
With much esteem,

Your very humble servant,

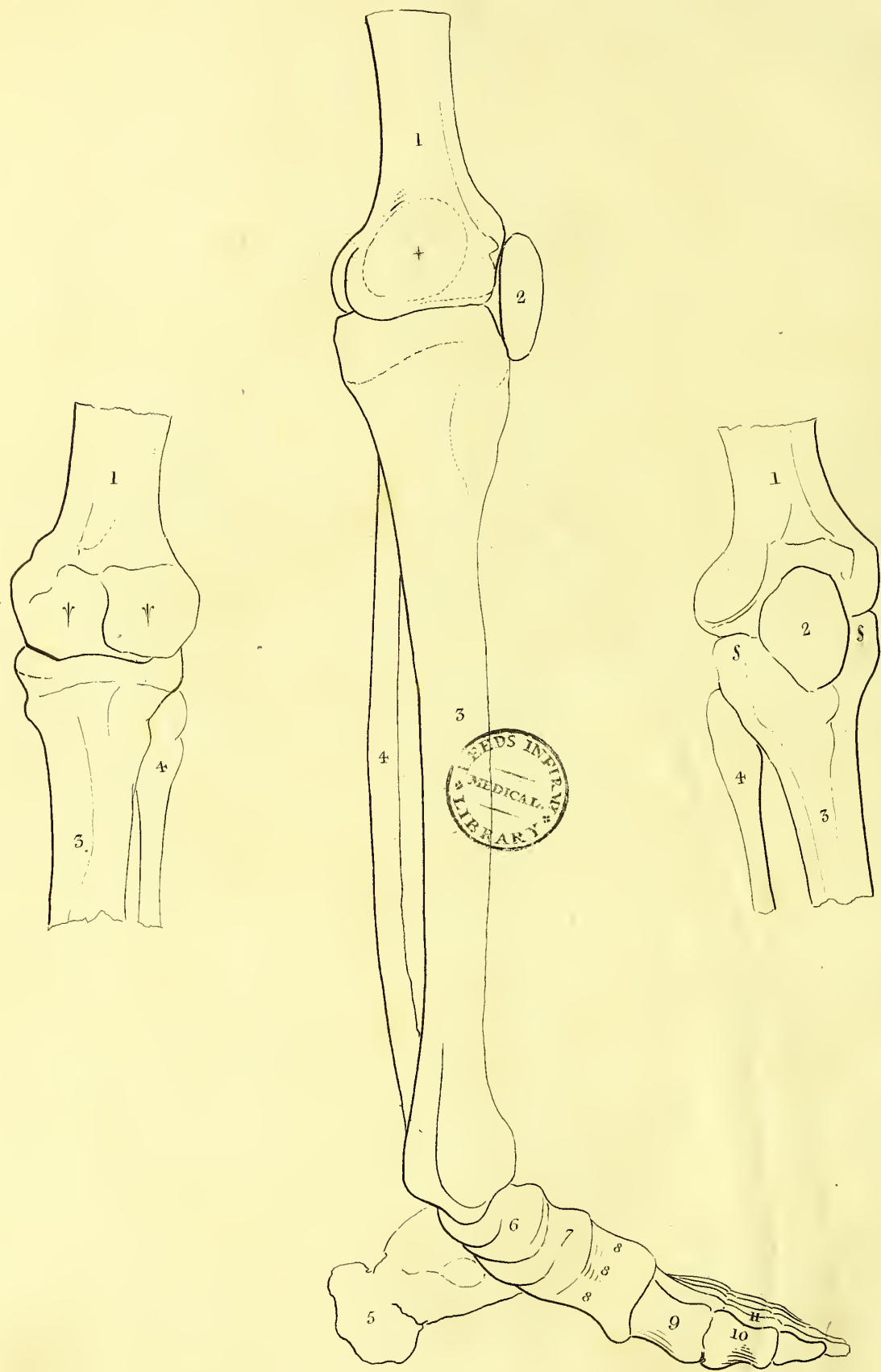
M. PALMER.

Feb. 13, 1794-

CON-



Drawn & Engraved by Kirk



P L A T E X V.

Hind View of the JOINT of the Knee.

1. Os femoris.
- *. Condyles of the thigh-bone.
3. Tibia.

*Inside View of the JOINT of the Knee, Patella, Bones of the Leg
and Foot.*

1. Side view of the os femoris.
- *. ————— condyle.
2. ————— patella.
3. ————— tibia.
4. ————— fibula.
5. ————— os calcis.
6. Astragalus.
7. Os cuboides.
8. 8. 8. Offa cuniformæ.
9. Os navicularæ.
10. The first metatarsal bone of the great toe.
11. Phalanges of the toes.

Front View of the JOINT of the Knee and Patella.

1. Os femoris.
2. — patella.
3. — tibia.
4. — fibula.
5. 5. — condyles of the tibia.

THE use of the bones in general respecting the body, are what a wooden frame is in respect to the whole building ; give strength and posture to the body by means of their different conformations ;—bones not only impart strength and power but in some degree shape also and grace to the whole human frame : and by reason of their hardness and stability, and of the manner in which they are framed together, are the foundation and support of the superstructure of all the other component parts of the body ; they defend the softer parts, and sustain the whole.

Some of the bones are hard and brittle, others more soft and spongy : they are all compacted of thin plates, and of thread-like substances called fibres, fastened one to another by very small filaments.

The bones are covered immediately on the outside with an exquisitely sensible membrane, nervous and vascular, called the *periosteum*, impregnated with by more or less moisture, partly oily and partly bloody, called marrow, contained in certain very small cavities denominated cells.

For a fuller and more curious description of bones and their articulation—see WINSLOW. Vol. 1. p. 17 and 41.

CONCLUSION.

TO sum up the whole ; the author must conclude as he set out, by entreating the candor of his readers to interpret in the most favourable manner his endeavours to explain his system of muscular action. He cannot but lament his incapacity to embellish his observations by elegance of style ; his fear is that of having often offended by the want of it, and sometimes even by defect of correctness : but his aim throughout has been so to express his own sense of the matter he was attempting to explain, that his readers might be enabled, impartially, to judge for themselves how far the means suggested by him, for the preservation or restoration of general health and for the alleviation or cure of local complaints, by the general or partial application and use of artificial muscular action upon a systematic plan, are competent with perseverance to effectuate the ends proposed, or to invigorate the natural powers of the human animal œconomy.

“ Muscular Action has very much tortured the brains of many philosophers, and *hitherto* no instance can be found,

either in natural effects, or in those of art, by which we can regulate and determine, to a given degree, the space, velocity, and duration, of any artificial motion.

“ Till some such LUCKY DISCOVERY is made, the utility of muscular action will be but a mere *hypothesis*.—To understand the uses and contrivance of each muscle in particular, we must consider its situation, direction, lateral connexion, relation and composition of its parts: we ought likewise to examine, how the neighbouring muscles are disposed for producing simple motions, and how those that are at a greater distance, can produce combined or compound motions.”

WINSLOW, vol. i. p. 160.

To have made the beginning of reducing the hypothesis to a system, illustrated by the demonstration resulting from practical proofs, is the whole that he pretends to; and if he has had the good fortune in any effectual degree to unite theory and practice, in bringing forward to the public notice this “ lucky discovery,” he flatters himself that by having dignified it with the name of a science, will not justly expose him to censure.—All he means by having adopted that term, that he has taken more pains, and laboured harder to bring it into a more regular, perfect and systematic form than any other during *two thousand years*, or since Hippocrates; for no one hitherto has pointed out the various applications requisite to relieve local complaints, however

often the repetition of the words “use exercise”—in answer to this it might be said use medicine;—but medicine as well as exercise, used without judgment or indiscriminately, is more likely to do harm than good.—Indeed we have no instance in the annals of the healing art, where the action of the human muscles has been illustrated, though general recreative exercise (obviously inadequate to remove the effect of diseases) has been so strongly recommended: for it requires the power of the limbs even to perform the trivial amusement of “a game at shuttle-cock,” recommended by CHEYNE.—Upon the whole it clearly appears, that the principles of scientific muscular action adapted to disabled patients, have “hitherto” been found wanting.

If we are struck with the productions of genius, in which the artist captivates us by an imitation of nature, and teaches the canvas or the marble to represent life, with what satisfaction ought we to behold the corporeal faculties actually regained or restored to their wonted powers, or the wheels of life, nearly motionless, again set into action.

However well engraved the tables of Albinus, taken from dead subjects or preparations, (the original plates of which have sold for 30 guineas and upwards) they do not serve to explain the requisite action of the joints and muscles, in their distinct, united and relative motions, according to the plan and end proposed in the system now for the first time submitted to the public, so effectually as the representations

to be contained in the plates of this work, which, with great diligence have been drawn from dead and living subjects under the immediate and attentive inspection of the author.

There is in fact, upon comparison of them with those above-mentioned and the drawings of other skilful anatomists, as much difference in the representation of a dead and living muscle, as between the appearance of a dead body and a man alive and active; and that appearance of life, action, extension and relaxation, is preserved in these figures, highly worthy the attention of students in drawing, painting, sculpture and anatomy.

The debilitated, arthritic, and sedentary, will also have an opportunity to determine for themselves respecting the rational principles whereupon relief is offered.

F I N I S.



